MAY 17 1944

The Welding Engineer

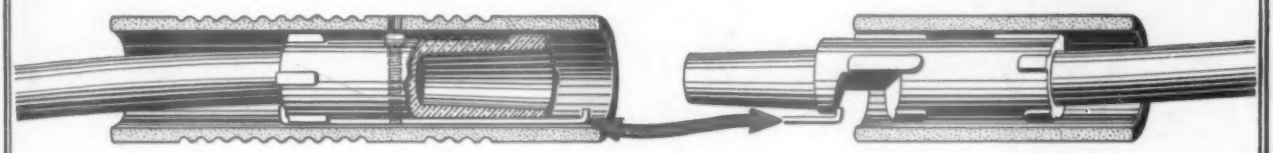
MAY, 1944

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

Jackson's QUIK-TRIK CABLE CONNECTOR

Locks TIGHT, quickly unlocked

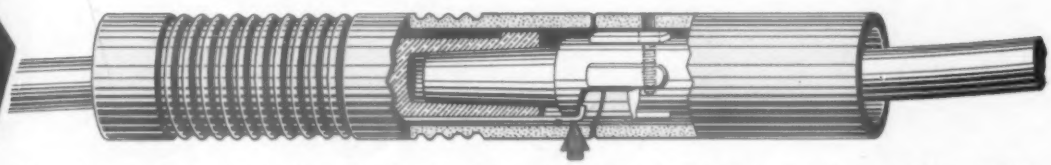
—fully insulated . . . SAFE



Female Section is soldered to cable lead Male Section is soldered to cable extension

Removable insulators are securely held in protective position with Allen screws.

HOW IT WORKS..



Connection is made by inserting Male Section into Female Section. Then, with a twist, the locking spring rides the cam into position holding both sections tight.

To unlock, simply twist apart.

PATENT APPLIED FOR

Important: Female Section, installed on cable lead, as shown above, may also be used as a handle and connected directly to the "Stinger" end of a Jackson Model TA holder as shown below. The adaptation saves time and material, eliminates the danger of live cable ends and makes possible the economies of standardization.

Contact your nearest Jackson dealer or write for Bulletins D and D-CC.

(above) Typical cable extension assembly for users of Jackson Model TA holders.

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In Canada: Hollup Corporation, Limited, Toronto • Paragon Supplies, Limited, Vancouver

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the Holder with the DETACHABLE "Stinger"

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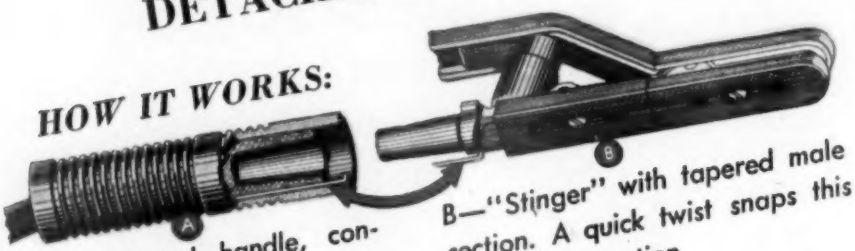
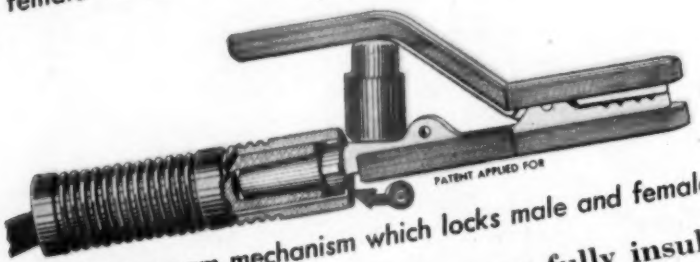


A—Insulated handle, containing female cable connector.

B—"Stinger" with tapered male section. A quick twist snaps this into female section.



C—Actuating cam mechanism which locks male and female.

Jackson's "Quik-Trik" holders are fully insulated, scientifically ventilated. Model TA-1 rates 300 Amps., takes rods to 1/4 in., inclusive.

TA-3 is a heavy duty 500-Amp. job taking rods to 3/8 in. inclusive.

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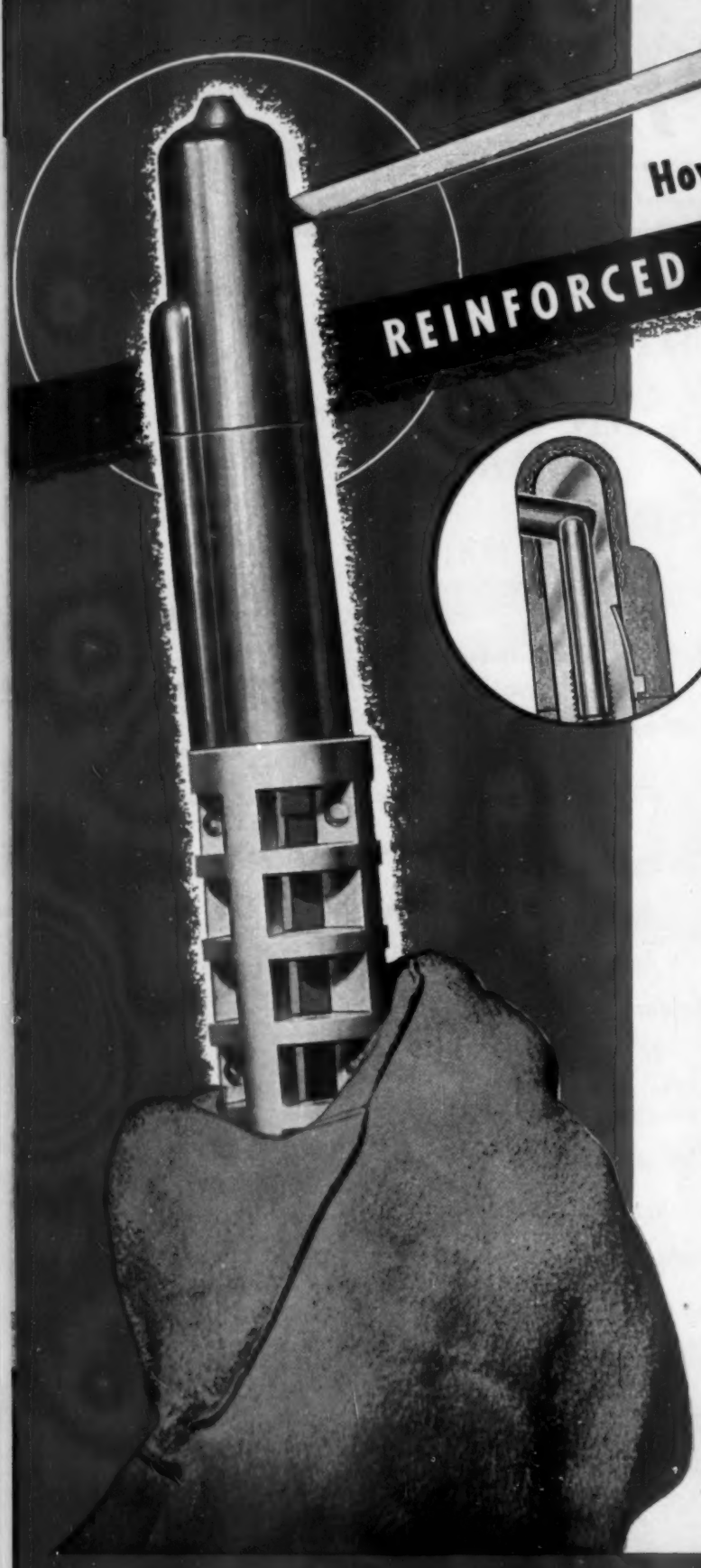

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

Welding Is Not a Toy

The minds of men are filled with interesting ideas, many of which reach print. Some of these thoughts emanate from the minds of reformers who insist we must have a new world formed to the order of their pet Utopias, but others come from individuals who wish to offer practical constructive suggestions.

Thoughts of the latter type are needed, but they should be based on facts rather than on dreamers' fancies. Unfortunately, all too many of those who pass on their thoughts and opinions by printed words are inclined to deal with subjects of which they possess little or no actual knowledge. No great harm would be done, of course, except that their dreamings are taken as facts by equally ignorant readers.

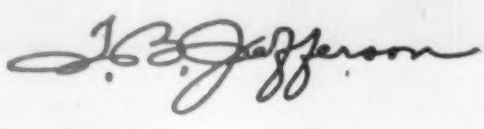
All of which leads up to the April 8th issue of *Collier's* in which Soothsayer David O. Woodbury prophesied some rather astonishing things for welding in the everyday life of the farmer in the postwar era. Mr. Woodbury, who writes well and entertainingly, visualized the postwar farmer as being equipped with a small portable electric welding machine using "no more current than the churn or electric pump." This beautiful picture breaks down because one simple technical fact was blandly overlooked: satisfactory arc welding of heavy material simply cannot be done with low currents.

Except in the case of very large farms having extensive machine shops, the farmer won't be able to "do the job himself." It makes good reading to say so, but welding will not "bring a new day to the farmer of tomorrow, for the first time allowing him to do his own repair work on farm machinery." The farmer of tomorrow will continue to patronize the job shop weldor just as he is doing now during the war years. Want to bet on it, Mr. Woodbury?

Nor will there be welding outfits like those our seer visualized: "Rugged, light in weight and inexpensive, these welding outfits can be run by any handy man who can diagnose the trouble he is trying to fix." Oh yeah? Many shipyard and war plant weldors have experienced difficulties when called upon to weld a different metal or in a different position from that to which they were accustomed. On the farm, every job presents a new problem—a problem which simply can't be solved without an extensive background of past welding experience to draw upon.

As for welding machines that "will use no more current than the churn or electric pump," that is really something. It takes power and heavy currents to bring metals with high melting points to plastic state; nothing ever developed can possibly alter this elementary fact.

Crystal-gazers please take note: welding is not a toy. Those who have made it an indispensable part of our everyday lives did so only because of their ability to combine the knowledge of the metallurgist, the technique of the foundryman and the skill of the master craftsman. It takes all of these qualities—plus patience and expert diagnosis—to effect a satisfactory welded repair, Mr. Woodbury.

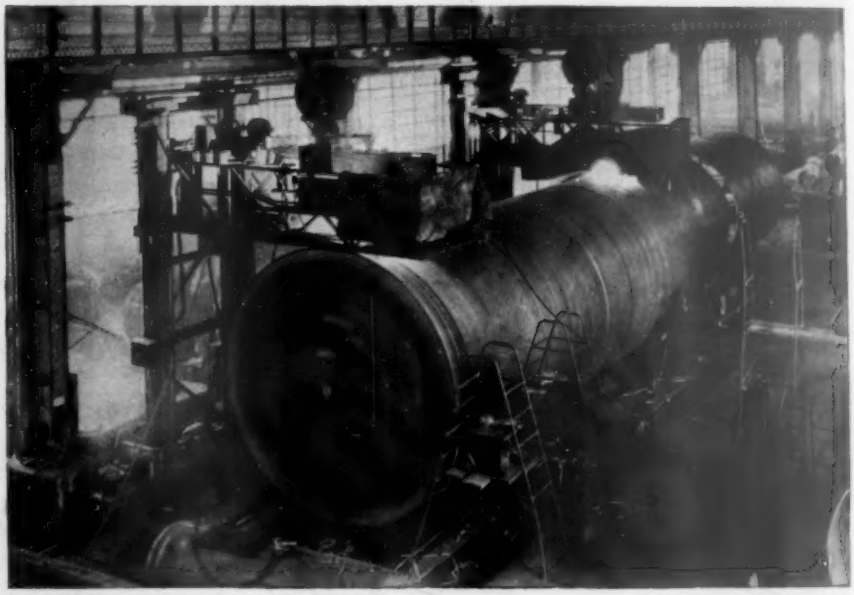


AUTOMATIC WELDING has many advantages in fabricating boiler drums, cracking stills and other products for which repetitive welding is practical. Deposit rate is often greater because of the use of higher currents, and a larger ratio of welding time to working time, compared with manual welding. The strength and high quality of the weld are due to the close control of the arc and the excellent fusion possible at high currents using Murex Electrodes.

Murex rods available for automatic welding are Type F, Carbon Moly. 50 and Cromansil. The spiral asbestos winding of these rods anchors the coating to the core wire so that the electrodes may be coiled without cracking and also provides an absolutely concentric coating that does not spawl off under the slitter.

THIS STRIKING action photograph illustrates the use of Murex Electrodes in welding the top member of a single action, single eccentric press, fabricated by Clearing Machine Corporation. Press frames are positioned with only four turns. The sides weigh from 80,000 to 90,000 lbs. and some plates are 10″ thick. Double-Vee welds, back-stepped, are employed.

HUGE PRESSURE VESSELS over 6′ in diameter, up to 35′ long and having a shell thickness of 4″ to 5″ are welded automatically by Foster Wheeler Corporation with Murex Type F and Carbon Moly. 50 electrodes in continuous coils. The soundness of the weld metal is shown by the fact that as many as 44 longitudinal boiler drum seams have been welded consecutively, with only five minor defects showing up under X-ray examination.



CRANE GIRDERS are subject to severe overloads and the shock of sudden stops and quick reversals. Manning, Maxwell & Moore, Inc., applying a special technique, uses Murex Electrodes in the construction of its "Shaweld" crane girders. They are much stiffer laterally than riveted girders and more resistant to the twisting motion set up by the driving machinery. Positioning cradles are used to permit downhand welding on the girders which are exceptionally long and heavy.

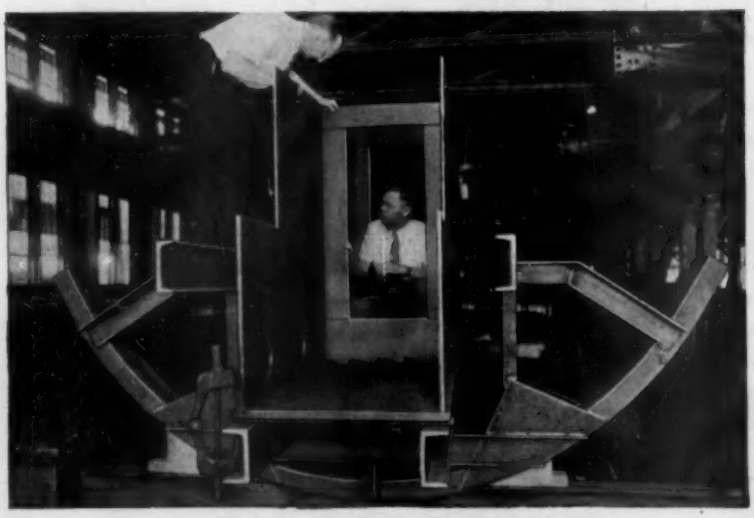


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Fig. 1—Cutting through a 42 in. thickness with a heavy-duty cutting machine. The numerous transverse motions had to be racked by hand with this equipment.

Flame-Cutting Big Crankshafts

Because wartime necessity made the normal procedure of forging and machining impossible, flame-cutting had to be used to produce giant five-throw ship crankshafts. Thicknesses up to 42 in. were successfully cut with the torch during the course of this important assignment.

By **R. L. DEILY and E. BENYO**
Bethlehem Steel Co., Bethlehem, Pa.

THE DEMANDS of the accelerated shipbuilding program made it necessary to produce, for rapid delivery in the rough-machined condition, numerous large five-throw crankshafts. Since normal forging and machining methods of producing these crankshafts would have made an early delivery impossible, it was decided to flame-cut these big shafts. Though nothing like this had been done before, torches and cutting technique had been developed for cutting depths up to 51 inches, and it appeared certain to us that the operation could be done.

Material and Dimensions

The slabs from which the crankshafts were cut were of ordinary mild steel (approximately 0.25% carbon), normalized and annealed to a minimum tensile strength of 60,000 psi. These slabs were forged about 10 feet wide by 25 feet long by approximately 25 to 28 in. thick in the main body. One end was forged approximately 38 to 42 in. thick in order to provide for a heavy flange on the finished crankshaft. These dimensions made it possible to lay out and cut two crankshafts from a slab, as shown in Fig. 1, with most of the center section of the slab becoming scrap. The crankshaft contours were generally laid out with three throws to the outside and two throws to the inside.

Precautions Prior to Cutting

After forging, the slab was annealed to remove forging strains and preheated to approximately 400 F before cutting. Previous experience with the flame-cutting of heavy forgings of this type had indicated that both of these precautions are necessary to make quite certain that there will be no cracking. As a further safeguard, the crankshafts were stress-relieved at about 1,050 F after cutting. By observing these precautions, a large number of forgings was flame-cut without difficulties.

Fig 1 shows one of the machines used—a heavy-duty straight-line cut-

Fig. 2—This large stationary cutting machine permitted all of the cuts to be made mechanically.

ting machine with an unusually long side reach. This large machine was necessary in order to carry the heavy hoses and control equipment and to keep the torch steady when the torch arm was extended. The numerous transverse motions up to 18 inches in and out had to be racked by hand, an operation calling for expert control in order to maintain the even speed of about 2 inches per minute required. The large stationary cutting machine shown in Fig. 2 was later available. This machine permitted us to make all cuts mechanically.

Cutting Speeds and Pressures

The job has been performed with both the oxy-acetylene and oxy-propane flame, the latter being used prior to the time we acquired the proper equipment for the oxy-acetylene application. The cutting speed for both gases is 2 to 3 inches per minute on the 28 inch thickness. With propane, the pressures at the control valves are 90 psi for cutting oxygen, 40 psi for propane and 120 psi for the preheat oxygen. When using acetylene, the pressures are 90 psi for cutting oxygen, approximately 15 psi for acetylene and 40 psi for preheat oxygen.

The large volumes of oxygen required are fed to a valveless torch through a ½ in. hose. A micrometer control valve is inserted in the hose at a convenient point to control the flow. In this way, with full line pressure approximately 150 psi at the valve, the operator can vary the torch pressure at will over a rather wide range without seriously restricting the flow for any given pressure. The torch is also designed without pressure restrictions since it is only a straight tube from rear to front. This arrangement, shown in Figs. 1 and 2, is largely responsible for the successful cutting performed.

The 42 in. Cuts

In the general illustration, Fig. 1, the operators are cutting through the 42 in. thickness. This necessitated racking up and in on the S-shaped forged lift of the flange. The starting operation was, naturally, one of the most critical steps in the procedure. We found, however, that the cuts would start the majority of times if we allowed a sufficient period for flame preheat and provided the proper sequence of turning on the high-pressure oxygen, starting the machine and operating at the correct machine speed. A lance was kept available to assist in starting if necessary.

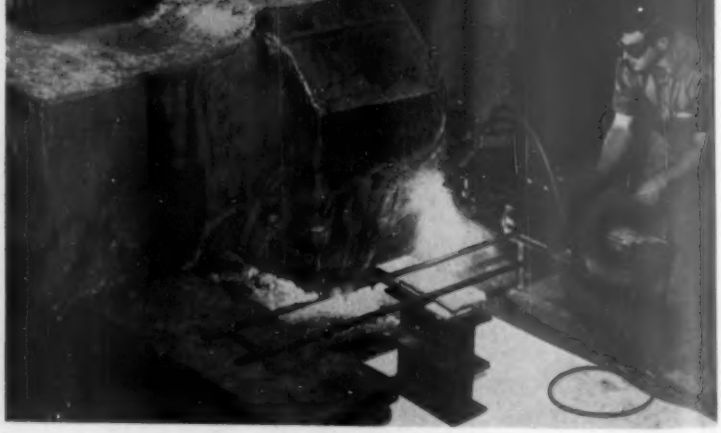
Fig. 3 is a close-up of a cut through a 42 in. section; in this view the cut proceeded from the inside to the outside of the flange. Fig. 4 shows the machine set up for bevel cutting of this same 42 in. section. Bevel cutting was done in order to reduce the machining time needed for turning the flange.

Fig. 5 shows a close-up of the cut through a 25 in. section at one of the throws. This cut proceeded from left to right, although the photographer's lighting makes it appear to have been done in the opposite direction.

The completed crankshaft blank is shown in Fig. 6. The shaft has been

Fig. 3—Note the clean contours of this cut through the 42 in. thickness.

Fig. 4—Machine set for bevel cutting of the 42 in. section shown in Fig. 4. This operation was done to reduce machining on the flange.



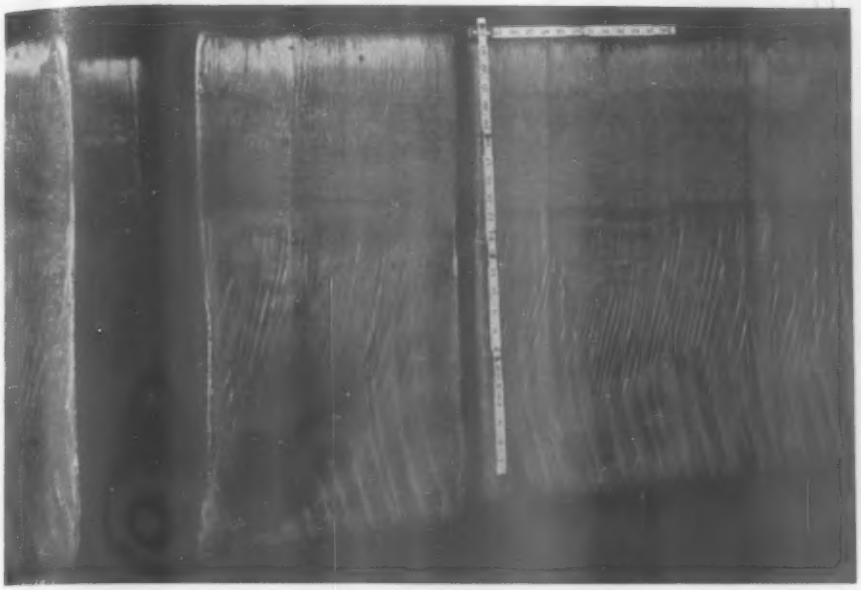
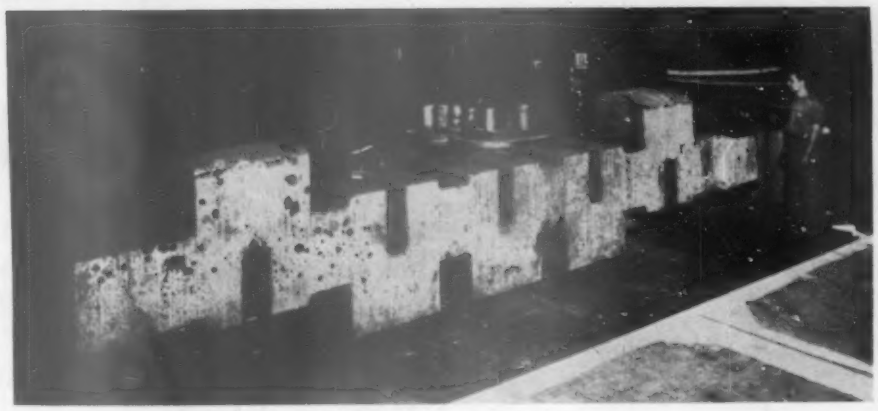


Fig. 5—Close-up of cut through a 25 in. section at one of the throws. This cut proceeded from left to right, although it appears to have been made in the opposite direction.

ing and heat treating. The allowance for flame-cutting on the 25 and 28 in. thick section was one inch over the finished surface; on the heavy flanged end, where the depth of cut was about 40 in., the allowance for flame-cutting was about two inches.

In conclusion, it may be stated that the flame-cutting of these crankshafts represents a job which contributed very materially to the war effort. It was the culmination of several years' development of torches and flame-cutting technique and is, no doubt, the forerunner to a more extensive use of this flexible production tool.

Fig. 6—Crankshaft blank as →→→ *it appeared after cutting.*



turned over on its edge with the three-throw side downward, and a clear view of the flame-cut contour as well as the forged face is provided. This blank is stress relieved at about 1,050 F and sent to the machine shop. Here it is set up on a spindle for rough turning of the bearings between the throws. The shaft is then taken to the forging furnace, where it is heated and the throws are twisted into their proper places. The twisted forging is heat treated to acceptable physical properties and returned to the machine shop.

Fig. 7 shows the twisted and heat-treated forging as it arrives in the

Fig. 7—Crankshaft after stress relieving, rough turning of the bearings, twisting of the throws to their proper places and heat treating to acceptable physical properties.

machine shop. The further steps involved in the preparation of the crankshaft are standard machining operations. As a matter of interest, we include Fig. 8 showing the final rough-machined condition in which the crankshaft was delivered.

One and Two In. Allowances

The final flange diameter of approximately 34 in. (see right end of Fig. 8) should be compared with the 42 in. thickness of the original forging. This seemingly heavy tolerance (8 in.) was not necessary from a cutting standpoint, but it was needed to allow for shifting the shaft in order to compensate for possible changes during twist-

Fig. 8—Crankshaft in the final rough-machined condition in which it was delivered.

Fig. 1—Silver-lined acid dehydration column. These vessels were constructed in six sections and bolted together through steel back-up rings. The 18 in. section at the right will be at the bottom when the column is installed.

Welding Silver-Clad Steel

This new material is tricky, but important industrial uses for it have been found. It took skill, patience and ingenuity to overcome the many difficult welding problems encountered in the "pioneer" fabrication of large silver-lined columns for an oil-refining process.

By **ARTHUR SCHWARZ and WALTER B. MEYER**
John Nooter Boiler Works Co., St. Louis

SILVER has long been regarded as a metal too precious for use in the construction of processing equipment. This belief is probably due, at least in part, to the constant association of silver with gold in our monetary system. Actually, its price of $11.68 per avoirdupois pound puts domestic silver within reach of the engineer as a material for the construction of those items in which its advantages are needed. Moreover, the ultimate cost is still further reduced by the fact that 50% to 75% of the original cost of the material is reclaimable at scrap silver prices.

Silver's Advantages

Silver is resistant to alkalis, to organic acids, to certain concentrations of hydrochloric acid and to some of the other mineral acids. Furthermore, its resistance to these corrosive media is inherent in the element itself and not the result of a protective oxide film. Silver, therefore, lends itself to use under conditions where an oxide film would be destroyed.

Silver salts are colorless—a fact that often makes silver the desirable material for use in equipment where discoloration of the product by dissolved metal is objectionable.

Silver leads all other metals in both electrical and thermal conductivity. Its high thermal conductivity is often an aid in shortening the operating cycle of heat transfer equipment and also permits the use of smaller equipment.

The silver used in the construction of chemical equipment is of the grade designated as "fine silver," a 99.9% pure element. Fine silver is considerably more pure than either sterling or coin silver, both of which are alloyed with copper to enhance their physical properties. While fine silver does not possess the physical properties often necessary, it does possess superior corrosion resistance.

Silver-Clad Steel

The problem of combining the corrosion resistance of fine silver with the desirable physical properties of steel has been solved by the manufacture of silver-clad steel plate and sheet. This is quite similar to nickel-clad steel. A layer of fine silver is bonded to and rolled down with a base slab of steel. The resulting plate is silver on one side and steel on the other.

Silver-clad steel is available in practically all combinations of thicknesses. The amount of silver cladding is referred to as a percentage of the total plate thickness rather than in fractions of an inch.

The advent of silver and silver-clad steel for industrial use has solved many vexing corrosion problems, but it has likewise given rise to a host of fabrication problems. This is particularly true in welding.

A Pioneer Fabrication

An example of the problems encountered with silver clad is provided by the "pioneer" fabrication of silver-lined hydrofluoric acid dehydration columns for an oil-refining process. These vessels were designed by the

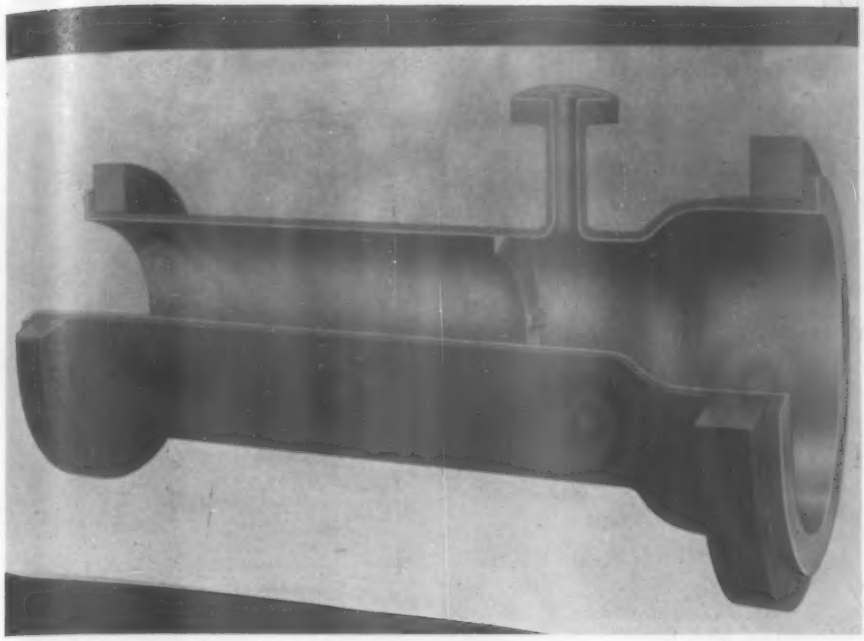


Fig. 2—Artist's cutaway sketch of the fifth or "transition" section. Note the nozzle of 2 in. ID pipe and the grid ring supported on gusset lugs. Both of these pieces introduced complications.

Universal Oil Products Co. for use in the hydrogen fluoride alkylation process. The John Nooter Boiler Works Co. contracted to build almost a score of the columns, which were to be fabricated of silver-clad steel plate.

Each unit was made up of six separate sections, as shown in Fig. 1. The overall length of a complete unit is 28 ft. Four of the sections are 14 in. in diameter and were made up of silver-clad steel plate 3/8 in. thick overall and with silver thickness of 15% or approximately 1/16 in. The fifth section (Fig. 2) comprised a transition piece to the 18 in. diameter of the lower section. This lower section is shown at the right of Fig. 1. Eighteen inches in diameter throughout, it was fabricated of silver-clad steel 7/8 in. thick, 10% (about 1/8 in.) silver, and was surrounded by a jacket of firebox quality steel 5/8 in. thick.

Start with Flat Plates

The clad material of which these units were fabricated was purchased in the form of flat plates. Excepting the pressed silver-clad flue heads forming the transition of the fifth section and the bottom elliptical head, the flat silver-clad plates were rolled and formed in Nooter shops.

The welding of silver and silver-clad steel gives rise to several unusual problems. The electrical and thermal conductivity of silver is such that its "hot short" characteristics may lead to cracking in the welds. How this tendency was overcome will be told later. It is also most essential that all silver surfaces be thoroughly cleansed of grease and foreign matter before welding.

Edge Preparation

Both the longitudinal and circumferential seams were vee-beveled on an edging planer before the plates were rolled. The bevels are shown in Fig. 3. Those in the 3/8 in. plate (top sketch) were machined with a 60 deg included angle. The bevels in the 7/8 in. plate were cut to form a standard "U" bevel having a "land" 1/16 in. wide on the steel just below the cladding. This is shown in the bottom sketch of Fig. 3. After cutting the steel, the silver cladding was removed for a space of 3/32 in. on each edge. Thus a 3/16 in. gap in the cladding was left when the edges were butted together.

The first weld metal was applied from the silver side with coated mild steel electrodes. Care was taken to assure complete penetration of the 1/16 in. "lands" on the 7/8 in. plates. The opposite side (steel side) of this weld was then chipped away to solid metal, and the steel weld completed with proper reinforcing overlay.

Welding the Silver Side

Next the silver side of this weld was ground flush with the steel surface below the cladding, thereby presenting a smooth, pit-free surface. To this surface, a fine silver bead was applied by means of the atomic-hydrogen process. The filler rod used was a bare rod of fine silver (99.9% pure).

Silver welding naturally presents its own problems—all of which, however, can be overcome with skill and care. Silver melts at 1,762 F and is quite brittle near melting temperatures because of the element's tendency to absorb 22 times its volume of oxygen when melted. For this reason, it is desirable to preheat in order to insure slow cooling and to complete the expulsion of the absorbed oxygen.

On all silver welding, it was found advisable to apply a preheat of 1,000 F to the entire section. The continuation of the preheat as welding progressed was also found necessary. The temperature was accurately checked by means of a pyrometer throughout the operation.

The silver welding rod was melted down without the use of flux, which was avoided to prevent the introduction of impurities into the weld. The avoidance of a flux and the continuance of the preheat throughout the welding operation are probably the two most outstanding peculiarities of a silver-clad welding job. As soon as the final silver had been deposited, the bead was peened while the temperature was maintained between 600 and 650 F.

Our experience indicates that it is desirable to limit the number of heating cycles to a minimum. Emphasis was placed, therefore, on the deposit of as much silver as was possible during the first heat.

Nozzle and Grid Ring

The job was greatly complicated by the 2 in. ID flanged nozzle and the

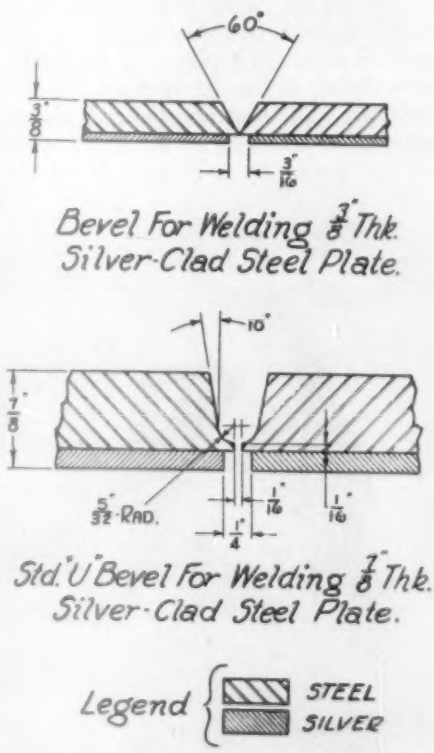


Fig. 3—Methods of edge preparation for 3/8 in. and for 7/8 in. silver-clad plate.

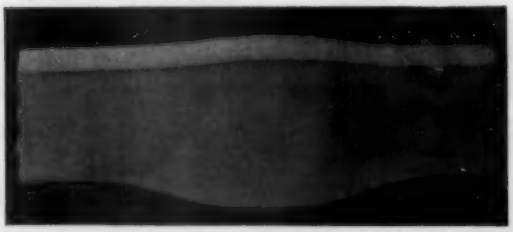


Fig. 4—Cross-section of weld in ⅜ in. silver-clad plate. The weld in the cladding is not readily apparent.

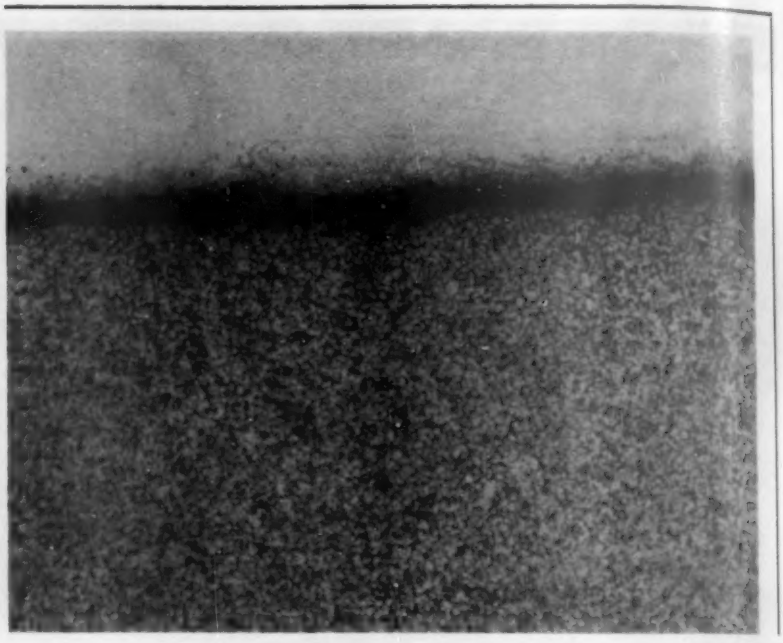


Fig. 5 (right)—Etched (5% nital) transverse section of weld in silver-clad steel. Magnification, 100 X.

grid ring shown in the artist's cutaway sketch of the transition section (Fig. 2). The nozzle was constructed of extra heavy steel pipe, and the steel flange was attached by arc welding. The pipe was welded to the steel side of the shell. A corresponding length of 2 in. diam silver tubing having a 1/16 in. wall thickness was then inserted inside the pipe and welded to the inner cladding of the shell. The other end of the silver tubing was welded to a silver washer attached to the face of the flange. Needless to say, all of this was difficult and exacting welding work.

The grid ring was originally designed as a solid bar. However, it was found to be impracticable to apply a complete circumferential fillet weld of silver because of the "hot short" characteristics which caused cracks to appear. The grid ring was therefore redesigned so that a silver ring 1 in. wide by ⅛ in. thick would be supported on six gusset lugs. These lugs were welded by the oxy-acetylene process to bearing plates ⅛ in. thick, care being taken to preheat before welding. The lugs and bearing plates were then attached to the inner wall of the vessel by a procedure which included preheating, atomic-hydrogen welding and peening, as previously outlined. The silver ring was then laid in place and tack welded to the silver lugs.

The six sections which made up the complete column were bolted together through heavy steel back-up rings. Gaskets of fine silver were placed between the sections.

Test Results

Extensive laboratory tests of welded silver-clad samples were performed in developing our welding procedure for this job. The results of these tests were both interesting and gratifying.

Fig. 4 is a 5% nital-etched cross-section of a weld in ⅜ in. thick silver-clad steel plate. The photograph clearly indicates the steel weld with its reinforcing overlay, but the weld in the silver cladding is not apparent.

Fig. 5 shows a transverse section of the steel-and-silver welds in the same specimen shown in Fig. 4. The magnification is 100 X. Complete recrystallization has taken place, and a normal bond is indicated.

Fig. 6 shows six 1 in. transverse strips of welded clad plate which were bent to approximately 180 deg. Three of the samples were reverse bent, while the other three were face bent. No failures of the welds or of the bond between the silver and the steel are evident in any sample.

Inasmuch as these units were destined for refinery service, all procedures were carried out in strict accordance with the specifications of the API—ASME code. The columns were designed for an internal operating pressure of 175 psi at 450 F with an external jacket pressure of 450 psi at 450 F.

Fig. 6—These six strips of welded clad plate were bent approximately 180 deg—three reverse bent and three face bent. No failures occurred.

★PRODUCTION

Tanks for Big Navy Guns

Because they are important to the action of the Navy rifles now driving terror into Jap hearts, electric-hydraulic rammer tanks must be fabricated to close tolerances. This means that there were many difficult welding problems to solve at Northern Ordnance.

By **T. B. JEFFERSON**

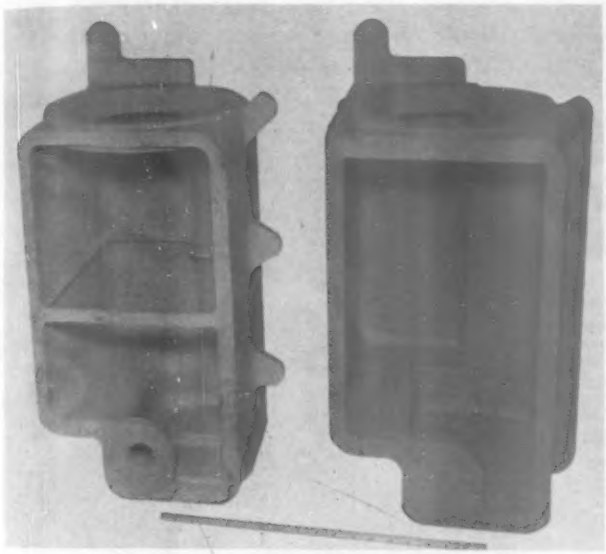


Fig. 1—Bronze casting (left) for Navy gun mount rammer tank and the welded steel tank that was developed to replace it.

THE TERM "welding" includes design, production procedures, purchasing and fabrication at Northern Ordnance Incorporated. This company, located just north of Minneapolis, is the world's largest producer of Naval Ordnance machinery. It was one of the first fourteen plants to receive the coveted Navy "E" award for production and has since received four renewals of this award.

Design for Welding

At Northern Ordnance Incorporated, welding has been recognized as a highly desirable metal-joining process for producing component parts of Naval armament—and as a process which requires special design and production considerations. In all too many plants, "welded design" means that the welded product is the same as an item designed for riveted construction except that holes and rivets are omitted. Plants a trifle more modern will go so far as to put the notations "weld here" on drawings, leaving the design and engineering up to the weldor. Vastly different is the procedure at Northern Ordnance Incorporated, where a special section of the engineering department has been organized to insure that welded fabrications will be properly designed. This welding engineering section — located in the same building as the welding department — is devoted exclusively to the design and tooling of fabricated structures for efficient production.

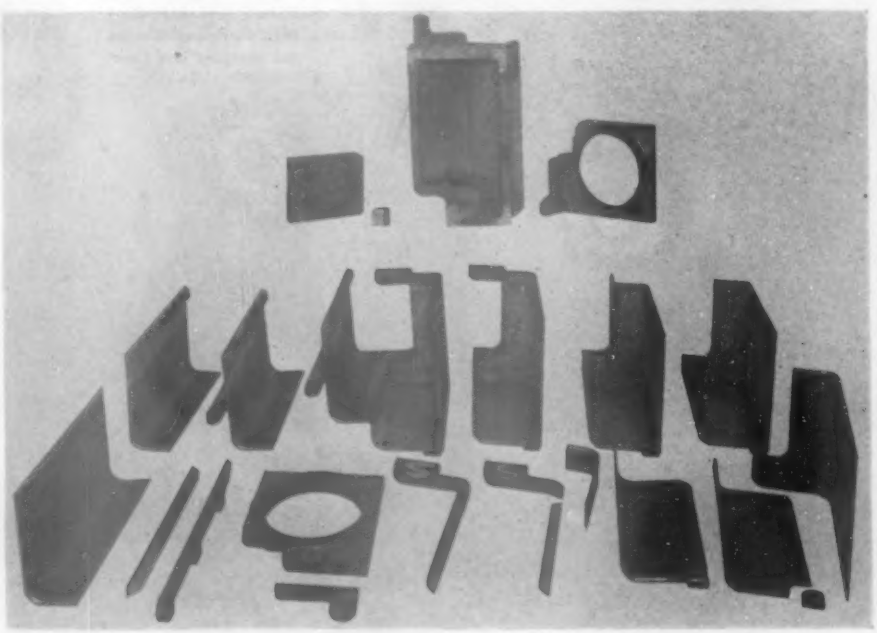
When a new or revised product is designed in the main engineering department, a rough layout giving the required dimensions and limits of the weldment is routed to the welding engineering section for design. The item under consideration is broken down into component parts, always with the thought of simplifying the welding operation and controlling distortion. After the welding procedure and assembly sequence have been laid out, work is begun on the design of welding jigs, fixtures and gauges. Gauges are used wherever possible to simplify the layout and checking of surfaces that are to be machined.

All Departments Coöperate

As soon as the engineering has progressed sufficiently, the purchasing department begins to order material and a production schedule is established. The purchasing and production departments also maintain sections in the welding department so that a close coöperation of all sections can be maintained.

A typical example of how a welded design project is handled is provided

Fig. 2—Pieces and subassemblies which go to make up the completed tank shown in the background. The steel plates used range in thickness from 1/4 to 1 1/2 in.



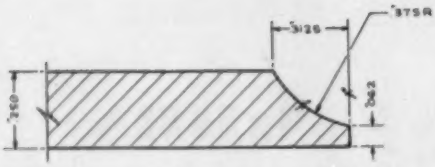


Fig. 3—Modified "J" groove (machined) developed for edge preparation of 1/4 in. plates.

by the electric-hydraulic rammer tank for a 5 in. 38 caliber Navy gun mount. The rammer tank houses the pump and hydraulic fluid which drives the rammer spade that pushes the shell into the breech of the gun prior to firing. In its original design, the tank was a bronze casting (left, Fig. 1) weighing 158 lb. Bronze being a critical material, a substitute for this casting was required. The engineers of Northern Ordnance Incorporated therefore developed a 142 lb welded steel tank which was tested and approved by the Navy Department for this application.

13 Pieces to Join

In all, thirteen different pieces of steel plate ranging in thickness from ¼ to 1½ in. are required for this assembly. These pieces are flame-cut, machined or flame-beveled, formed and welded to produce the several subassemblies and the finished tank shown in Fig. 2. The task of obtaining a satisfactorily fabricated rammer tank was not an easy one, however, since several serious problems had to be solved.

Need Machined Groove

One of the first problems encountered was the development of a satisfactory weld groove for edge preparation of the lighter plates. The original welded design called for the flame-cutting of all edges to a standard bevel. This was quite satisfactory on the thicker plates but proved unsuitable on the small ¼ in. plates due to an excessive amount of root chip-

Fig. 4 (left)—This welding fixture is used to produce the left side assembly.

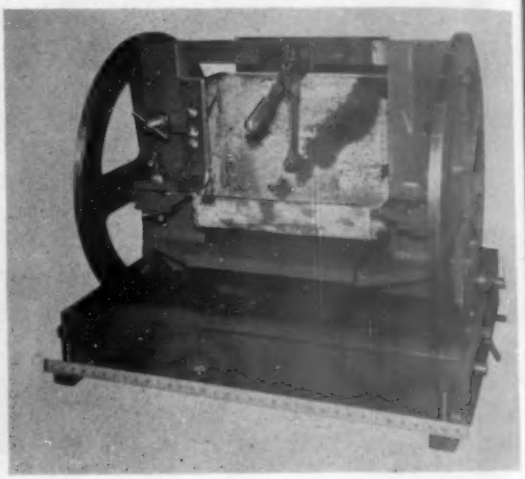


Fig. 5 (right)—For the right side subassembly this fixture is needed.

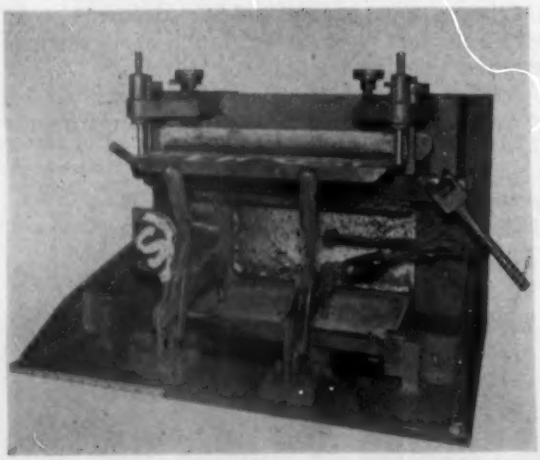


Fig. 6 (left)—One of the two fixtures (see Fig. 7) required for the joining of the left side and right side subassemblies.

Fig. 7 (right)—This fixture is used to hold the weldment during the chipping and root-welding (see Fig. 6).

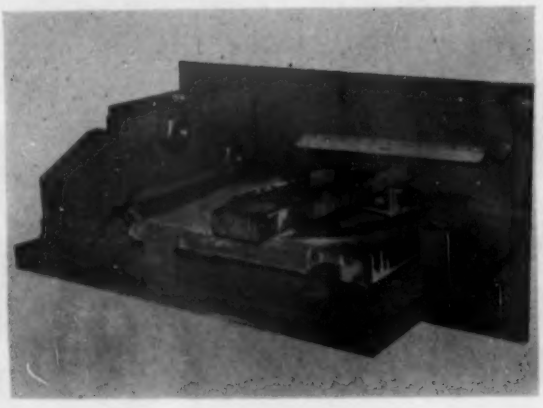


Fig. 8 (left)—Fixture for the minor subassembly constituting the rear end of the tank.

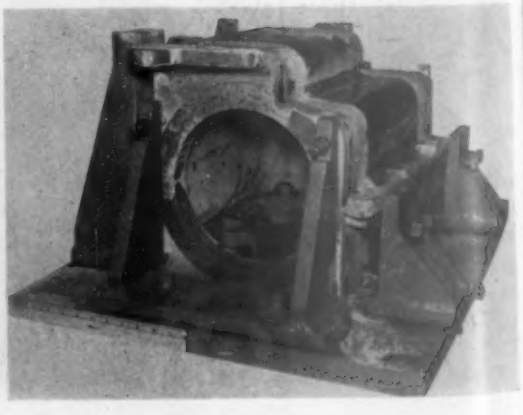


Fig. 9 (right)—First of the two fixtures used for final assembly. Only tack welding is done here. The assembly is then transferred to Fig. 10.

ping and welding, with consequent excessive distortion and cost. Experiments were conducted with different grooves until a machined groove of a modified "J" type (Fig. 3) was developed. This proved superior for this application and was accordingly adopted for the ¼ in. plate.

Jigs and Fixtures

The redesign of the tank was simplicity itself when compared to the design of the jigs and fixtures that were required to put this item on a production basis. One reason why jig and fixture design was so important was the close tolerance (plus or minus 1/16 in.) which had to be maintained in the overall width. Such a figure seems a little unreasonable in view of the fact that 13 pieces are to be joined by means of 17 ft of welded joints, but this tolerance is necessary since there is only a 1/16 in. clearance between the tank and the breech operating handle.

Twelve different types of fixtures, two forming dies and a final layout gauge or jig are used. This may seem like a great many tools for such a small part, but all are quite necessary in order to maintain the tolerances and production required. Each fixture —in itself an elaborate weldment— provides a means of rigidly clamping the various parts during welding and also provides limiting stops to insure that alignment, height and length are within the tolerance limitations. (Some of the fixtures purposely misalign the parts to counteract welding distortion and shrinkage.) The parts are held in place on the jig by quick acting toggle clamps or large wing nuts in order to speed loading and unloading. Most of the fixtures are designed so that they may be mounted on rotating and tilting positioners, permitting welding and chipping to be accomplished on both sides of the seam without removing the work from the fixture. These fixtures, it should be noted, are not the usual tacking fixtures but are designed with sufficient strength and accessibility to permit welding of the groove and chipping and welding of the root without once removing the work from the controlling influence of the fixture.

Side Subassemblies

The first operation in the welding of a gun mount rammer tank is the joining of the flange to the long side of the tank. In this operation, the long side stamping and the flange are fitted in the welding fixture pictured in Fig. 4 and held in place by quick acting toggle and wing clamps. After the welding has been completed on the inside, the fixture is rotated 180 deg to enable the chipper to remove the non-fused area in the root of the weld. While the fixture remains in this position, the weldor deposits the final bead. The bolt rail is then welded to the side to complete the left side subassembly of the tank.

The right side subassembly consists of three stampings: the drain plug boss and two upper flange pieces. This subassembly is fabricated in another series of jigs, one of which is shown in Fig. 5. These two major subassemblies are now to be joined in the beginning of the final assembly—an operation that was found to be critical in the fabrication of the tank. The inside weld is first made in the fixture shown in Fig. 6, and the piece is then transferred to an extremely heavy fixture (Fig. 7) for the chipping and root-welding operation.

Adding the Ends

All that now remains to be done is the addition of the ends and the front foot. The rear end of the tank consists of the minor subassembly shown in its welding fixture in Fig. 8. This fixture was designed so that welding can be accomplished from both sides without removing the piece.

The final assembly is begun by tack welding the work in the fixture shown in Fig. 9. After the parts have been tacked, the assembly is transferred to the fixture pictured in Fig. 10 for the final assembly, root chipping and root welding. It should be noted that the final welding and chipping fixture has been mounted on a positioner so that the fabricated piece may be rotated to any desired position and all welding may be done downhand.

Production procedures are carefully laid out before fabrication begins and are continuously checked afterwards to see if any improvement in the flow of material can be effected. One of the main objectives of these process sheets is to insure the uniform sequence of operations that was originally planned during the design of the fabricated unit. Complete in every detail, this procedure outlines the sequence of steps that are to be followed from the time the material is drawn from the stockroom until the completed unit is ready to be shipped to the machine shop.

Magnetic Inspection

Weld inspection plays an important part throughout the entire welding operation. Upon completion of each joint, the weld is magnetically inspected; if a defect should be discovered, it is immediately chipped out and the piece is rewelded and reinspected.

After welding has been completed, the rammer tank is checked for accuracy of dimensions and stress relieved. Stress-relief annealing at the Northern Ordnance Incorporated weld shop is done at a temperature of 1,175 F, plus or minus 25 F, for six hours. This period of time is allowed in order to accommodate the heavier sections of steel that may be included in the furnace load.

The rammer tanks are grit blasted after stress relieving and any uneven welded surfaces or plate edges are evened by chipping and grinding. The units are then magnetically inspected again and rechecked for dimensions. If the rammer tank passes this final inspection, it is painted and passed on for machining operations, after which it will be installed on a 5 in. 38 caliber Naval gun.

Fig. 10—From the tacking fixture (Fig. 9), the final assembly is moved to this positioner-mounted fixture for chipping and root welding.

The Welding Engineer—What's His Job?

★Part Three—Though the welding engineer's job may vary in different organizations, certain basic responsibilities are more or less common to all manufacturing plants. Mr. Brooking analyzes these common factors in detail in his three-part series on arc-welding engineering problems.

By **WALTER J. BROOKING**

Director of Testing & Research
R. G. LeTourneau, Inc.

There are at least ten basic welding engineering functions which must be performed by someone if the welding department is to operate efficiently. In the first installment (February issue), Mr. Brooking discussed the selection of processes and equipment. Last month he took up the evaluation of welding electrodes, the testing and training of weldors, the correlation of various plant departments and the design of welding fixtures.

The present and final installment covers the remaining four functions —the establishment of general welding procedures, the establishment of a production control, the establishment of quality control and ways by which the engineer keeps abreast of new practices and processes.

VII. Procedures for Welding

WHEN the product is to be made on a mass production basis, check sheets such as shown in Fig. 10 should be made up to give the individual steps, one after another. Such procedure sheets must include (1) the setting up of the parts and (2) the stepwise deposition of the welds in the proper sequence in order to minimize or control the effects of distortion. The check sheets should give an engineered set of specifications which will answer the operator's questions such as, "Which part shall I set up first?" and "Which weld shall I make and in what order?" These specifications should, of course, allow for standardizing of operations, with resultant standardization of products.

In the case of the production of an individual machine or only a few machines, the planning will be done by the set-up man who is building the unit or may be accomplished by special notes on the blueprint from which the set-up man works.

In mass production operation, care should be taken to see that the fixtures available are used to their best advantage. The efficient use of fixtures is an important part of welding engineering.

	ELEMENTS				
1.	Check in parts				
2.	Turn,pos.bk.plts.in jig,tack & weld seam				
3.	Pos.&tack top curved plate				
4.	Pos.&tack bot.curved plate				
5.	Pos.&tack frt.plates,tack&weld seam 1st pass				
6.	Turn,W.frt.plates to top curved plt.				
7.	Turn,W.frt.plates to bot.curved plate				
8.	Turn,W.bk.plates to top curved plt.				
9.	Turn,W.bk.plates to bot.curved plt.				
10.	Turn,Bolt shv.jig to main jig				
11.	Pos.&tack apron shv.&single shv.				
12.	Remove shv.jig				
13.	Pos.&tack spacer plt.,W.apron shv.to frt.plt.lt.side				
14.	Pos.tack &weld gusset to spacer,pos.&tack to A frame				
15.	W.single shv.&gusset to frt.plt.(outs.)				
16.	W.gusset,spacer & apron shv.to frt.plt.(ins.)				
17.	W.apron shv.(outs.rt.),spacer & sgle.shv.ins.to frt.plt.				
18.	Pos.,tack,&weld rt.tailgate shv.				
19.	Pos.tack & weld brace to tailgate shv.&frt.plt.				
20.	Pos.tack & weld lt.tailgate shv.				
21.	Pos.tack & weld brace to tailgate shv.&frt.plt.				
22.	Turn,W.side of tailgate shvs.to back plates				
23.	Turn,W.shv.braces to top plt.(1st side)				
24.	W.spacer plates to apron shv.&sgle.shv.(ins.)				
25.	Turn,W.shv.braces to top plt.(2nd side)				
26.	W.apron shv.to top plt.,rt.spacer to apron shv.&top plt.outs.				
27.	W.lt.spacer to single shv.,apron shv.&top plt.(outs.)				
28.	W.apron shv.(ins.)to top plt.				
29.	Turn,W.2nd pass on frt.plt.seam				
30.	Turn,remove structure to floor				
31.	W.seams,frt.plts.ins.,back plts.(outs.)				
32.	W.tailgate shvs.to back plates				
33.	Aside str.,paint no.,pos. card.				

TOTAL	
JOB NO.	
UNIT NO.	

DATE_____

SCRAPER DEPARTMENT
F 9016 LS "A" FRAME
Setup & Weld

Fig. 10—Establishment of an orderly sequence of operations in the fabrication of welded structures is necessary for most economical mass production. This check sheet gives the sequence of operations for a heavy earth-moving machine.

VIII. Production Control

There are certain phases of the detailed welding process which should be prescribed as a written specification. Otherwise, there will be variance in processing, which will be reflected in variations in appearance of the finished product, lack of interchangeability of parts and variation in the cost of production. Production control is especially necessary in the mass production of welded products.

The details which should be specified for each weld comprise the answers to questions which the welding operator should ask (and have answered) in his mind before he strikes an arc on the structure. They are briefly as follows:

1. Where should this structure be welded?
2. What size of weld should be deposited?
3. What cross-sectional view of form will this weld have when it is finished?
4. In what position should the joint be welded?
5. How many passes of weld metal should be deposited to make this weld according to the best procedure?
6. What type of electrode should be used for each pass?

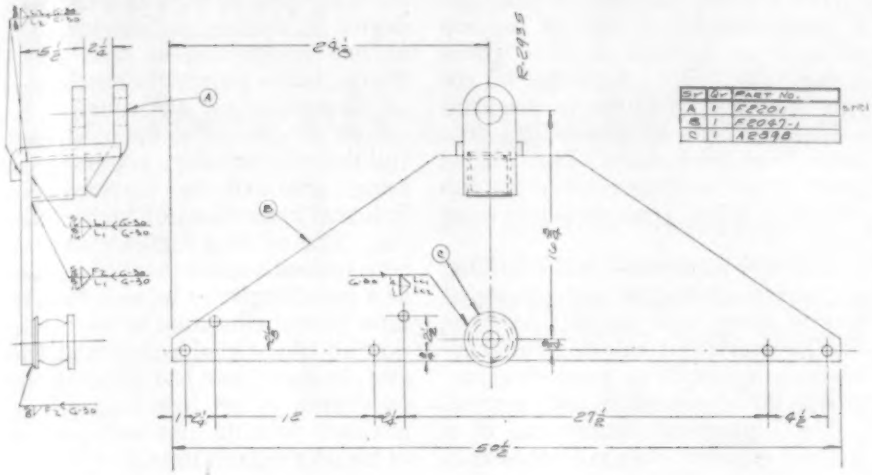


Fig. 11—Arc-welding symbols form a very practicable means of conveying engineering information in exact and complete detail to the weldor, welding foreman and welding inspector.

7. What size of electrode should be used for each pass?
8. What machine setting should be used for each separate pass?

Welding Symbols

The answers to these questions may be placed upon the blueprint of the structure by the use of welding symbols as shown in Fig. 11. The American Welding Society's symbols provide a convenient shorthand for the inclusion of much detailed information in small areas on the drawing or blueprint. These symbols have been recommended to the American Standards Association for adoption as an American Standard.

The imparting of information by means of welding symbols presents opportunities of control and economy on a considerable scale, especially for mass-production operations.

A certain amount of education on the part of the operator is required in order that the symbols may be correctly interpreted. This phase of weldor training can be standardized by the use of AWS welding symbols. Once the proper information has been accurately imparted to the weldor on the blueprints, the standardized welding procedure can be accurately maintained. One additional step must be taken in order to make a production control a success, and that is a continuous "crusade" to keep the fit-up of the parts on each structure up to standard.

IX. Quality Control

Whether there are complete specifications or not, quality control (inspection) must be practiced on any welding job. Someone in the organization must be responsible for checking the weldor's work, either periodically or all the time, in order to control the degree of perfection of the finished product. This is an important function of the welding engineer.

The inspection of welded products may require no more than the guided bend or other simple tests such as the air-and-soapy-water test* shown in Fig. 12. Contrariwise, it may involve special techniques as prescribed by codes and require apparatus and skilled technicians for its accomplishment. Examples of this are the X-ray, gamma-ray and magnetic-particle inspection methods used on pressure vessels, military equipment and the like. These non-destructive testing methods require a high degree of specialized training on the part of inspectors.

Associated with weld inspection is the education of the individual weldor to produce the correct size of weld and general qualities of appearance which lie within his control. This, also, is a phase of welding engineering —regardless of whether the information is conveyed by the welding supervisor, the welding instructors or by someone from the inspection department.

Failures in Service

Another type of inspection which is usually very informative is that of examining the structures which have failed in service. Such examinations usually yield profitable information for a welding organization. Failures which recur frequently may be caused either by a weakness in the initial design of the structure or by improper welding technique. Only by careful examination can the true cause be determined.

It may be to the interest of the company to set up a system for identification of the work of each individual weldor. This is an organizational problem, but it is also one of welding control and so may reasonably be considered to be a part of welding engineering.

*Hydraulic pressure tests are generally preferable to compressed air because of the lesser likelihood of external damage should the vessel fail. —*The Editors.*

X. Keeping Abreast of the Times

One of the best and easiest ways to keep abreast of the results of welding research is to read trade journals in the welding and metallurgical fields. Such magazines as THE WELDING ENGINEER and *The Welding Journal* present the technical as well as the practical aspects of current production. A thorough and regular examination of the leading literature of this type goes a long way towards keeping an organization informed as to the developments within the field.

Another effective means is to support the American Welding Society. Besides the excellent technical services it publishes, its local sectional meetings are valuable sources of information. These meetings supplement the printed word with talks and slides presented by specialists in particular fields. Such a speaker is always glad to answer questions from the audience after his formal lecture is over. The local meetings also serve to bring together members of the industry for good fellowship and the exchange of ideas. The benefits of this may be almost incalculable.

A good though more expensive means of keeping up-to-date is to visit plants in different parts of the country which are engaged in manufacturing similar products. Usually such visits of people from one plant

Fig. 12—The fuel tanks in this welded structure are being tested with compressed air and soapy water. Inspection is a necessary phase of welding production and warrants careful engineering study.

to another are of mutual value because of the opportunity for shop talk and the exchange of ideas on common problems.

The engineering services which are given by vendors of arc-welding equipment must not be neglected. Though the manufacturers naturally have their own interests in mind, the information which they give is usually associated with fundamental welding problems.

What Are His Qualifications?

It is impossible to describe exactly all of the qualifications of a welding engineer, but here are some of the most important of them:

The welding engineer should have a preponderance of interest in shop outlook, as opposed to the "white-collar" job. His knowledge of the processes and operation in the plant must come from shop knowledge, not from front office study. The detailed problems of welding engineering can seldom be solved from an office swivel chair.

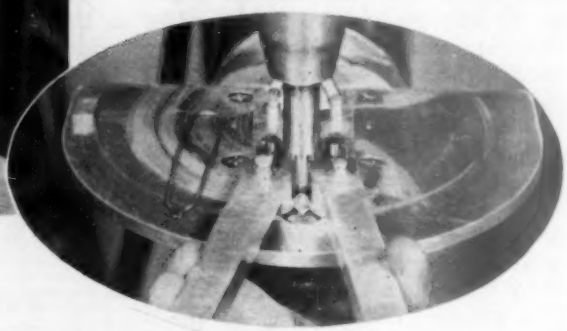
It is very important for the welding engineer to be tactful and capable of getting along with people; he must also be capable of carrying responsibilities and capable of promoting programs of organization and control.

The educational background of a welding engineer does not necessarily mean the graduation with a university degree in welding engineering. One or two institutions do offer such a degree, but in general the development of the welding art and education has not yet progressed to the point where full-fledged welding engineers are being produced by universities or technical institutions of higher learning. The welding engineer may have been trained as a mechanical engineer, as a metallurgist or he may have had little formal education at all. Whatever his educational background, however, he must have had sufficient shop experience to get him intimately acquainted with the unsolved problems of his own organization.

★

Spot-Welded Hose Straps

By **LEON MOORADIAN**
Ass't. Chief Research Engineer, Boeing Aircraft Company



The stainless steel wire stock is located in the fixture by using a metal block as a guide. The rear end of the forming block acts as a front locator. The operator pulls on the forming arms of the fixture, causing the wire to bend to the contour of the form block. The forming arms are offset slightly, which causes the wire ends to cross directly over the welding tip for the spot weld joining them together. The finished product is shown in the oval shaped picture below.

THOUSANDS of hours spent in the manufacture of a small hose strap used in Boeing Flying Fortresses have been saved by the use of a simple spot-welder attachment. Designed and produced by the tool design department of the Boeing Aircraft Co., Seattle, this attachment is just one of the lesser of the multitude of achievements through which the building time of the great bomber has been reduced by more than two-thirds since the war's outbreak.

The hoses and tubes for the various liquid and gaseous systems of the Flying Fortress are held in place by means of a strap or tube lock bent from a piece of 16 gauge stainless steel wire. A piece of this wire is bent into an oval shape about three inches long, and then the free ends are welded together.

Previously, the wire had been cut in one shop, formed in a second and flash welded in a third. Since cutting left the ends too irregular for flash welding, they had to be ground until they met each other squarely. Despite the extra process of grinding, rejections on inspection were running about five per cent because of faulty welds.

How to reduce production time and eliminate rejections was the job confronting the tool design department. After a thorough study of the problem, it was decided that spot welding would be more satisfactory than flash welding. But how could the straps be formed and spot welded with a minimum of effort and time?

The answer finally evolved itself into the attachment shown in the accompanying pictures—a circular fixture attached to the spot-welder arm. The fixture holds a die around which the wire is bent by two levers into the required form. Since the quantity of parts on order did not justify the cost of making a completely mechanical forming and welding device, the operation is by hand.

The wire is bent in one quick movement, which joins the ends in position for welding. A foot lever then operates the spot welder. The device has resulted in two workers producing as many straps in one hour as were previously produced by six persons in a full day.

The cost of the attachment was insignificant compared to the time saved, and there have been no rejections for faulty welds since it has been in use.

Servicing Welder Controls

Having few moving parts, electronic control panels are seldom the cause of troubles in resistance welding circuits. Sometimes trouble does occur, however. What to do then is fully told in this article by two "experts."

By **E. STOLTE and R. WASHBURN**

Westinghouse Electric & Mfg. Co.,
East Springfield, Mass.

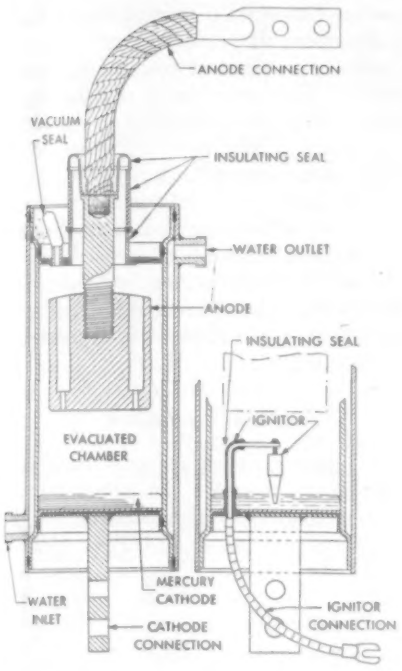


Fig. 1—Cross-section of typical ignitron.

PRESENT resistance welding practice demands currents of extremely short duration, sometimes as short as one, two or three cycles. Magnitude and duration of the welding current must both be held within extremely close limits to assure success of the welding process. These demands upon resistance welding machines can only be satisfied with electronic controls.

Before the introduction of the vacuum tube, the resistance welding process depended on mechanical contactors. The initial cost of a contactor is low, but its maintenance is relatively high because of the periodic replacements of contacts and other mechanical repairs. Other disadvantages of the mechanical contactor are the annoying noise when operating, its sluggish action and its inability to close or open at a predetermined point on the current sine wave.

As far as seam welders are concerned, mechanical contactors are out because of the high number of operating cycles required. If the current should, for example, be "on" 4 cycles and "off" for 2 cycles, the circuit has to open and close a total of 600 times per minute.

Ignitrons have eliminated most of the disadvantages of the mechanical contactor for spot and seam welding. These mercury-vapor rectifiers can conduct as well as make and break several thousand amperes. Their operation is instantaneous and silent, and they can be controlled by other electronic tubes to conduct during any predetermined number of cycles. They can also be controlled to fire on the delayed part of each cycle and therefore, in effect, regulate the heat in this way. With electronic heat control, the number of steps is infinite, and adjustments can be made while the machine is operating, which is very useful on seam welding machines.

Ignitrons have no moving parts, and they are enclosed in oxygen-free tubes so that there is no burning or oxidation of contacts. All of these advantages point to a minimum of maintenance.

The Ignitron Circuit

The structure of an ignitron tube is shown in Fig. 1. An enclosed pool of mercury serves as the cathode while a graphite anode is supported at the top. One ignitron will pass alternately ½ cycle of a-c current to the welding transformer primary as long as the ignitron circuit is energized. When two ignitrons are connected in inverse parallel, one tube will carry the positive and the other the negative half cycle so that the welding current is continuous. Fig. 2 shows the fundamental circuit involved.

The ignitron will not start to carry current without forming a cathode spot. Hence an ignitor is provided, and the circuit is as shown in Fig. 3. Assuming that line 1 is positive and that the operating switch is closed, the ignitor current will flow from L-1 through the copper-oxide rectifier R-1, through the operating switch, and through the copper-oxide rectifier R-2 to the ignitor of ignitron No. 1. A cathode spot will form at the ignitor at the point where it makes contact with the mercury pool and negative electrons will be given off. These electrons will be attracted to anode A-1; their passage through the mercury vapor ionizes the vapor, and an arc is started. The current is then able to pass from L-1 through anode A-1 to the cathode and hence through the primary of the welding transformer.

Ignitron No. 1 will conduct for the duration of the positive cycle, and then ignitron No. 2 will conduct during the negative cycles. Thus a continuous current will be conducted as long as the operating switch is closed.

Use of Thyratrons

For precision welding, thyratron tubes are used to control the ignitor circuit. The connections are as shown in Fig. 4. The thyratrons, under normal conditions, are rendered nonconducting by applying a negative voltage to the grid. If we now superimpose a positive voltage on the grid (and the anode is positive), current will be able to flow from cathode to anode of the thyratron. From the anode, the current goes to the ignitor of the ignitron, which picks it up and passes it direct to the transformer. All of this happens normally in a few millionths of a second.

The grids of the thyratrons are controlled from a timing circuit. The timer may serve three functions: (1) to provide a number of cycles, (2) to control firing on the first cycle and (3) as an optional heat control with phase shift.

For proper operation, the ignitron demands a minimum load under which it will function. Since this minimum load is in the neighborhood of 40 amperes, it is imperative that the electrodes (spot or seam welder) be closed before any attempt is made to fire the

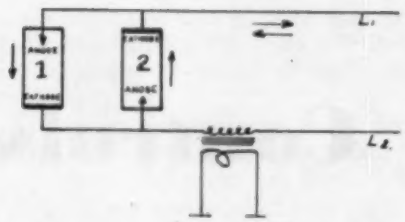


Fig. 2—Fundamental circuit showing two ignitrons connected in inverse parallel. One of these tubes carries the positive and the other tube the negative half of the welding current.

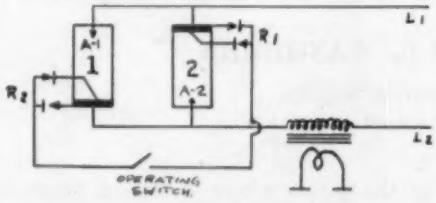


Fig. 3—Circuit diagram with ignitor added in order to cause the forming of a cathode spot.

ignitrons. When the secondary welding circuit is open, the current going through the thyratron into the ignitor is limited by the impedance of the welder, and the voltage drop across the primary is so high there will not be the proper voltage across the ignitrons. Hence the latter will not pick up the load to relieve the thyratron and ignitor, and damage can be caused.

Ignitrons in operation must be water cooled in order to keep them at a low temperature. This type of tube is built with a water jacket (see Fig. 1) through which passes a continuous flow of water. The water circuit contains a water-flow switch, which is operated by pressure or temperature difference. Should the water supply fail for any reason, the switch will break the control circuit and so render the tube inoperative.

The proper size of ignitron tube to be selected for a control circuit will depend on: (1) the amount of primary circuit to be conducted, (2) the average time of conducting and (3) the duty cycle.

Some Causes of Trouble

Given proper care and attention, an electronic control will work with a minimum of trouble and maintenance. Such a control unit consists of the electronic tubes, transformer, condensers, resistors, potentiometers, copper oxide rectifiers and usually one small relay. Except for the latter, there are no moving parts to wear.

Many times an electronic control is uselessly checked when the trouble lies solely with the welder or with the operator. On a cam-operated press-type welder, for example, the operator had been cleaning and refacing his tips without making adjustments for the removed material. Finally there was an excessive gap which permitted the contact switch to close without pressure between the tips. The result was that holes were blown through the material to be welded. This sort of thing has happened all too often.

Another bad condition on a cam-operated machine may arise when the timing cam is out of time, causing it to fire either too early or too late. In either case, damage will be done to the work.

A new operator complained about no current to weld. Investigation disclosed that he had placed some paper around the taper section of his electrode tip in order to stop a leak in the cooling system.

Keep Contact Surfaces Clean

A great deal of trouble will be encountered if the machines and contact surfaces are not kept clean. The best method of keeping them in good welding condition is to adhere to a regular cleaning schedule. Possible spatter must be removed from arms, shunts and housing in order to prevent shunting and loss of secondary current. All contact surfaces of tips, tip holders, arms and shunts must be cleaned periodically from dirt and oxide in order to keep the resistance low at these joints.

Loose connections or broken wires are a common source of trouble. It will pay dividends to give the electronic control panel a thorough going-over when it is first put in service. All screws, bolts and nuts should be tightened; all soldered connections checked. Hours have been spent in trying to track down erratic operation caused by a loose screw or loose connection.

Another hint: when installing control equipment, place it so that both the front and back are readily accessible. This facilitates trouble shooting.

An open resistor may cause an inoperative timing circuit. If the control has been inactive for several weeks (especially if it is located in a bad atmosphere or near corrosive fumes), an opened resistor is always likely. This trouble is not so apt to occur while the control is in operation because the heat generated inside the panel keeps everything dry.

The copper-oxide rectifiers should give very little trouble unless they are overheated. Trouble caused by a grounded transformer may develop, however, if the control is located in an atmosphere where there is a great deal of metal dust.

Tube Troubles

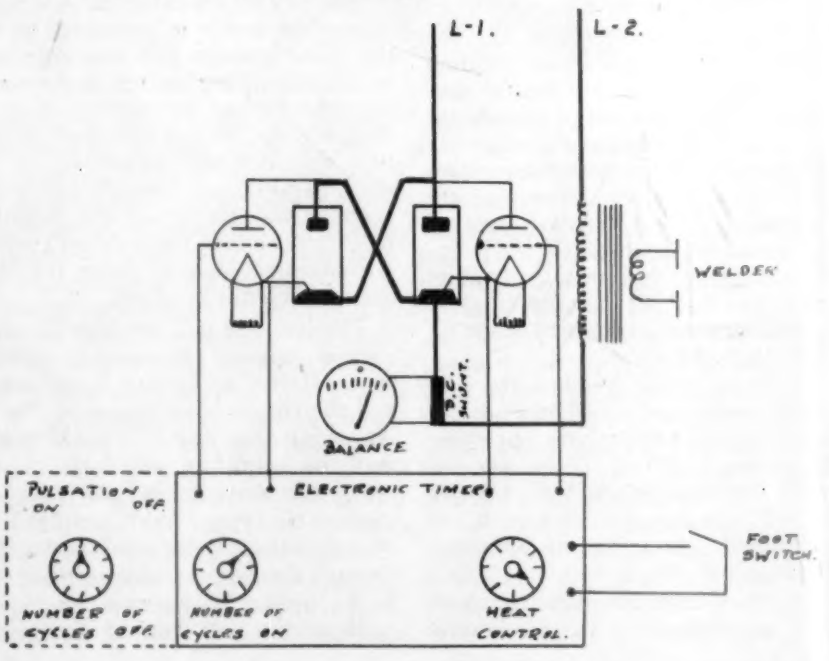
Electronic tubes are only rarely the source of trouble. If tubes of the proper size have been selected for the application, from 3,000 to 10,000 hours of service can be expected. There are installations where the tubes have been in service for seven years and are still good.

In checking for tube trouble, it is wise to observe the flashes or the glow of the tubes while they are operating. A clue may thus often be obtained as to where the trouble is.

A small percentage of tubes may be defective when new. Hence new tubes should be inspected for any loose elements before installation. A defective tube is usually detected when it is first installed or within 30 days.

The heater in the thyratron very

Fig. 4—Connections for thyratron tubes used to control the ignitor circuit.



seldom burns out like a lamp. Instead, the end of this tube's useful life is determined by the loss of electronic emission or loss of the vacuum.

The ignitron, in rare cases, may conduct current through the welder without the action of the ignitor circuit. This condition indicates that the tube has become filled with gas—in other words, has lost the vacuum in which the ionized mercury-vapor functions.

Broken Ignitors

The ignitor of an ignitron tube is made of graphite with a boron-carbide coating having a very high resistance. Should the ignitor break off, the graphite below the coating will be exposed. What follows then will depend a great deal on where the break occurs. If the break is such that the ignitor does not make contact with the mercury, the thyratron will not fire. If the ignitor is broken near the top and still makes contact with the mercury, current will flow directly into the mercury without forming a cathode spot. This will be evidenced by the bright blue flash of the thyratron as the latter tries to pass the primary current. A punctured ignitor, *i.e.*, one where the boron-carbide coating has been punctured, will act in the same way and have the same result on the thyratron.

On extremely cold days trouble may occur with thyratron tubes. The thyratron is also a mercury-vapor tube, and the vapor pressure inside it is controlled by the coldest spot on the base. No trouble should occur if the base feels hot to one's hand. This statement, however, applies only to mercury-vapor thyratrons—not to ignitrons.

Fuse Protection

It is the general practice to have a 6 to 10-amp fuse in the ignitor circuit. Such a fuse protects the thyratron in case of a broken-down ignitor and gives protection to both ignitor and thyratron in case of accidental firing with an open secondary circuit.

Some electricians think trouble is avoided by replacing the 10-amp fuse with a 30-amp fuse, but this practice puts the life of the ignitron at stake.

If overheated, the ignitron may pass current without control. Overheating will happen in case of water failure that is followed by failure of the water-flow protective switch previously discussed.

Use of Instruments

A d-c millivolt meter with zero center scale and shunt installed as shown in Fig. 4 will indicate either bad thyratrons or ignitrons. Should one thyratron be near the end of its life, it will work erratically and may be noticed by a violent kick of the needle to one side. If this condition exists, the thyratron tubes should be swapped around. If the kick is then in the opposite direction, one of the tubes is certainly at fault. Ignitrons may be checked by a similar procedure.

The man charged with the service and maintenace of tuning controls should have a universal volt-ohmmeter of one megohm capacity. This instrument may be purchased from any radio store or supply house, and it will help to find open circuit or check the various voltages for the different circuits. The instruction book and wiring diagrams for the control should be consulted.

A cathode-ray oscilloscope is often helpful in detecting unsuspected trouble. The oscilloscope permits checking of the sine wave for balance and power factor; the line voltage or current can be checked as well as the ignitor current.

☆

War Production Conference

RESISTANCE WELDING, automatic welding and oxy-acetylene applications were discussed before capacity crowds at the three welding panels of the Chicago War Production Conference. The conference was held at the Hotel Stevens, March 30th, under sponsorship of the Chicago Technical Societies Council, and the welding meetings were held under the direction of the Chicago Section of the American Welding Society. Eric Seabloom, Crane Co., was co-chairman, panel sessions committee for the entire conference. R. L. Kohlbry, Machinery & Weldor Corp., was chairman of the conference exhibits committee. Jim Quigley, welding supervisor, Graver Tank and Manufacturing Co., acted as general chairman of the welding sessions.

The resistance welding panel was chairmaned by C. L. Pfeiffer, electrical engineer, Western Electric Co. The session opened with a sound movie, "Aircraft Welding," produced by the United States Navy. Questions and problems from the floor were then answered by a panel consisting of A. M. Unger, assistant to superintendent, shipbuilding div., Pullman-Standard Car Mfg. Co.; W. B. Frackelton, district industrial electronics specialist, General Electric Co.; C. W. Dodge, engineer, Sciaky Bros.; Clyde G. Bassler, district manager, The Taylor Winfield Corp.; and J. M. Cooper, sales engineer, National Electric Welding Machines Co.

It was brought out that satisfactory spot welding of aluminum is possible only because of the development of satisfactory electronic controls and stored-energy spot welders. The diversified problems of flash welding were also discussed, and Mr. Dodge made mention of a new procedure developed by the shipbuilding industry which permits spot welding of scaled steel. A high voltage, low amperage current is used to burn off the scale prior to welding, and the process is restricted to thick materials.

Two welding sessions were held in the afternoon, one at 2 p. m. on automatic welding and one at 4 p. m. on the oxy-acetylene processes. The automatic welding session was chairmaned by H. M. Downing, service engineer, Lincoln Electric Co., while the other speakers were Ed. Morris, manager, Unionmelt Service, Linde Air Products Co., Inc.; L. G. Pickhaver, welding engineer, General Electric Co.; L. S. McPhee, welding supervisor, Whiting Corp., and Jim Quigley, welding supervisor, Graver Tank & Mfg. Co. Mr. Morris and Mr. Pickhaver discussed the submerged melt and atomic-hydrogen welding processes, respectively. Mr. McPhee covered the automatic welding of structural members and Mr. Quigley the automatic welding of pressure vessels. A cost comparison of automatic vs. manual welding was given by Mr. Downing.

The 4 p. m. panel was under the capable chairmanship of L. S. McPhee. Some of the latest applications of flame-cutting, flame-gouging and flame beveling were shown on slides exhibited by F. McGuire, Jr., division service engineer of Linde Air Products Co., Inc. Other slides showing the application of flame-hardening techniques to various war products were exhibited by Walter Handrock in behalf of Stephen Smith, development engineer, Air Reduction Sales Co., who was on the program but unable to attend.

The formal part of the last session closed with a discussion by R. D. Wasserman, president, Eutectic Welding Alloys, Inc., on low-temperature welding, brazing and soldering. Questions and answers followed as in the other sessions.

★TRAINING

Weldors in 40 Hours

Moore Dry Dock Company standardized welding instruction and found out that weldors capable of fine production work can be turned out with 40 hours of pre-employment training plus two to three months' training on the job.

Mrs. Edna Slocum—winner over 10,000 women weldors in the San Francisco Bay area—is here being crowned with a golden welding helmet by Movie Star Paulette Goddard. Mrs. Slocum, a ranch wife and the mother of two boys, was trained to championship welding form at the Moore Dry Dock Co., Oakland, Calif.

THE RECENT triumph of the Moore Dry Dock Company's Edna Slocum over women weldors from other shipyards in the San Francisco Bay area was mainly due, according to the winner herself, to the system inaugurated and standardized at Moore's. Edna Slocum should know whereof she speaks because she won her title as Bay champion in direct competition with more than 10,000 other women weldors and came close to wresting the national championship from Ingalls' Vera Anderson (SEE THE WELDING ENGINEER, March, 1944, page 96).

More and Better Weldors

The training system now in vogue at Moore Dry Dock not only turns out more weldors in shorter time but is credited with being over 30% more efficient than the methods formerly used. Hence a summary of the events which led to its establishment might prove to be of considerable value to those interested in making proficient ship weldors out of men and women in all walks of life.

When the great shipbuilding program began, Moore's, like all shipbuilding firms, found itself short of trained weldors. Pre-employment training schools, a trainee system of instruction on the job, and a system of supplementary training off the job were established. Difficulties began shortly to manifest themselves.

The techniques of various welding instructors naturally differed—by about as much as one person's handwriting differs from another's. This would matter little were it not for the fact that each trainee was taught by several instructors during his or her training period. Hence he was constantly confused by the different methods shown to him of doing the same weld.

The lack of uniform training seemed inefficient to Welding Superintendent Pat Doggett, so he arranged for his assistant, L. E. Van Beuning, to make studies and to set up a complete checking system on each method. Eighty arc time meters were placed on the machines to measure the actual arc time as a basis for recording.

Wide Individual Variations

The results were amazing. Weldors who worked side by side with identical machine settings and electrodes, under the same working conditions, were found to vary as much as 100% in the amount of metal deposited per unit of arc time. This could only be the result of the one uncontrolled factor—technique. The metal deposits were being cut down by excessive flagging, long arc lengths, arc blow and other faults.

Though the need for a uniform method of training was thus made apparent, the twin problems of finding the best welding technique and the best means of teaching it remained to be solved. All of the various methods of instruction and different techniques being used by welding instructors were checked, and it was then found that W. R. Stunkard, who was in charge of an Oakland testing station, had devised a new method of instruction that was both logical and efficient. His method was to break down the instruction into different steps which would follow each other as the student progressed in ability. Each step was explained in terms of the changes that occurred in the molten metal, on the plate and in the metal being transferred from the electrode to the welding surface.

Under the Stunkard system, the student was taught exactly what forces must be controlled and how. He learned to control and compensate for heat radiation, heat absorption, gravity pull, capillary action, magnetic pull, arc blow, drafts and other factors which had previously been given little attention by instructors.

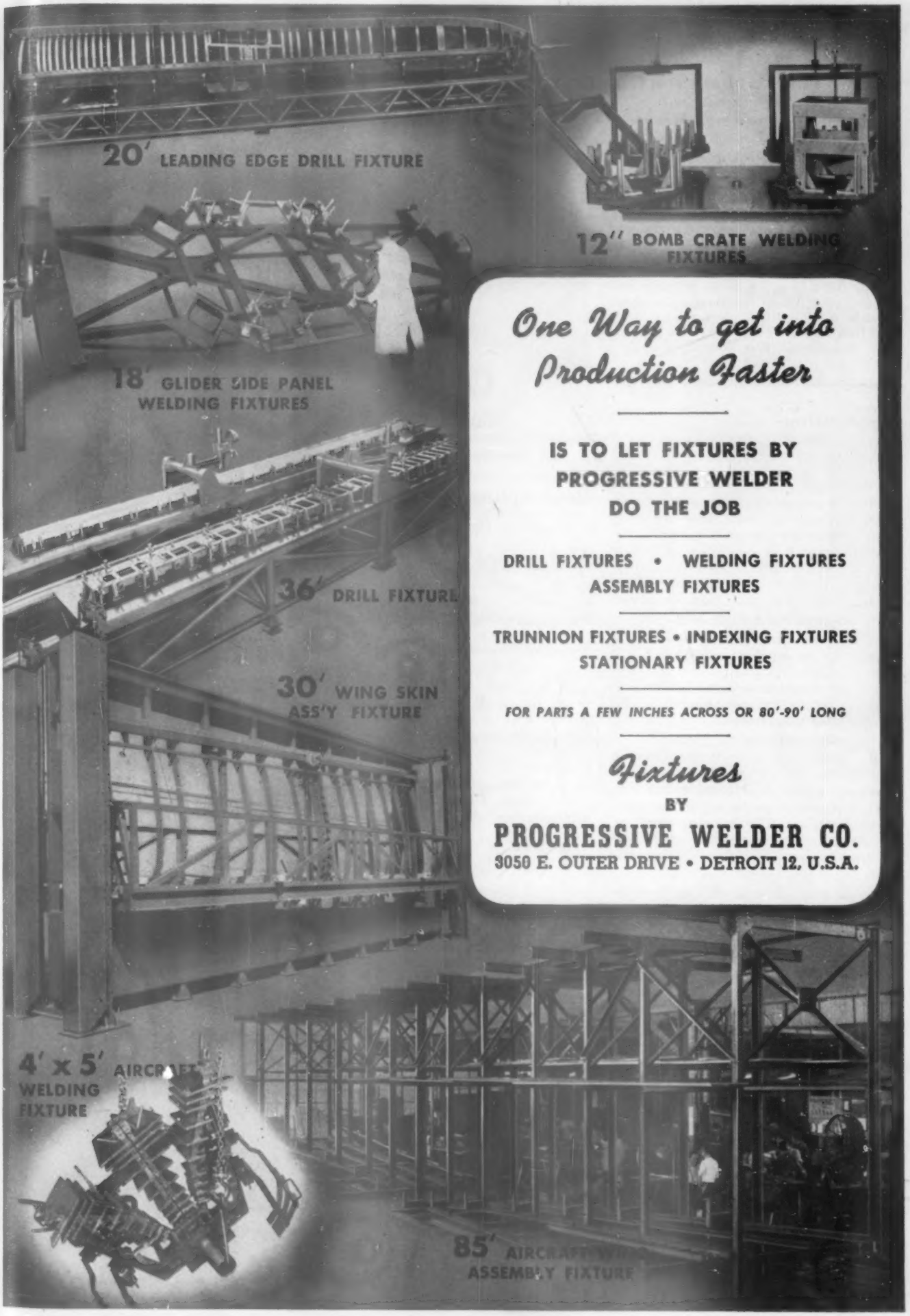
Teaching the Teachers

Messrs. Doggett and Van Beuning began their reform by first setting up a complete instruction department, under the direction of Vern Skugrud, exclusively for teachers. Every instructor in each of the two Moore yards, in the three pre-employment schools and in the supplementary training schools was required to attend a 32-hour course in order to standardize instruction.

The next step was to remove instructors from the production department and to place them in the educational department. Their own foremen, quartermen and leadermen supervised their activities. A complete text of the Stunkard system was made available for all instructors teaching the standardized system.

The results of all this are that Moore Dry Dock Co. is today turning out weldors in two or three months who are capable of fine production work. Despite their limited 40-hour pre-employment training, they are equal in ability to weldors who were trained in four or five months with a longer pre-employment training period. Furthermore, a rough check shows an increase of over 30% in the weld deposit in the same arc time.

These facts are increasingly important now that 60% of Moore weldors are trainees.


20' LEADING EDGE DRILL FIXTURE
12" BOMB CRATE WELDING FIXTURES
18' GLIDER SIDE PANEL WELDING FIXTURES
36' DRILL FIXTURE
30' WING SKIN ASS'Y FIXTURE
4' x 5' AIRCRAFT WELDING FIXTURE
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The Exchange of Ideas Leads to Progress

Help Wanted, *please!*

THIS is the one place where you may "get more than you put in," for all the ideas given here are yours without contributing anything in return. Don't be that kind of fellow, though! If you have a welding idea to pass on, then get the kick of seeing your name in print, help others to win the war and help us to keep this feature alive. Send anything you think suitable to Short Cuts and Kinks, THE WELDING ENGINEER, 506 South Wabash Ave., Chicago 5.—*The Editors.*

Disc-Cutting Unit

By R. F. Sheldrick

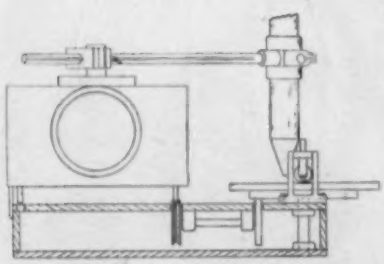
SHIPBUILDING requires many round steel discs for plugging holes in bulkheads, decks, pipes, etc. These discs are commonly obtained by cutting them from scrap plate—by hand if necessary but preferably with a flame-cutting machine. Manual cutting is generally used on small pieces of scrap, for these have been considered practically impossible to cut automatically.

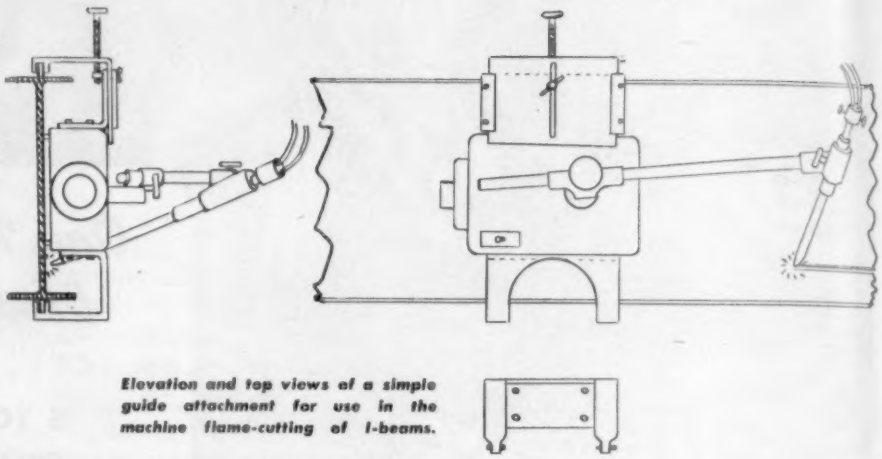
To overcome this difficulty, I submitted a suggestion to the War Production Committee at Marinship Corp., Sausalito, Calif. This suggestion was accepted, and a machine similar to the one sketched in the accompanying diagrams was built and put into operation.

This disc-cutting machine consists of a flame-cutting machine with an arm. The flame-cutting torch is attached to this arm, which is pivoted from the top and operates over a turntable. The latter is driven by a treadmill arrangement that is attached to the drive wheel of the flame-cutting machine.

The piece of scrap to be cut is center punched and held on the turntable by means of a weighted arm. The turntable is next set into rotation by starting the flame-cutting machine, and the disc is then flame-cut to the desired diameter. With this arrangement, steel discs can be cut to any desired size, and small pieces of scrap can be salvaged for useful purposes.

Front, top and left side views showing schematic set-up for adapting a small straight-line cutting machine to cut discs.





Elevation and top views of a simple guide attachment for use in the machine flame-cutting of I-beams.

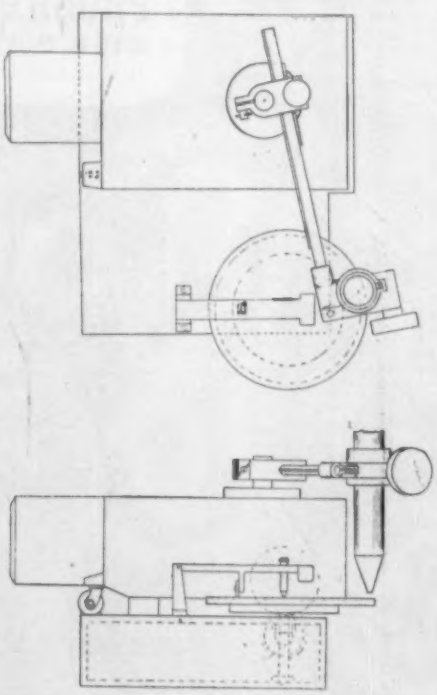
Beam-Splitting Guide

By David H. Saunders

IT IS general practice in shipbuilding to take I-beams and split them to obtain special T-sections. This work is usually accomplished by flame-cutting. As a result of warpage, which occurs in the beam because of the heat of the cutting flame, the T-sections are not true and are sometimes unsatisfactory for the desired use.

To overcome this fault, I designed a simple attachment for use with a flame-cutting machine. I submitted the idea to the War Production Committee at Bethlehem Ship, San Francisco; the suggestion was considered worthwhile and has been adopted as standard practice in our shipyard.

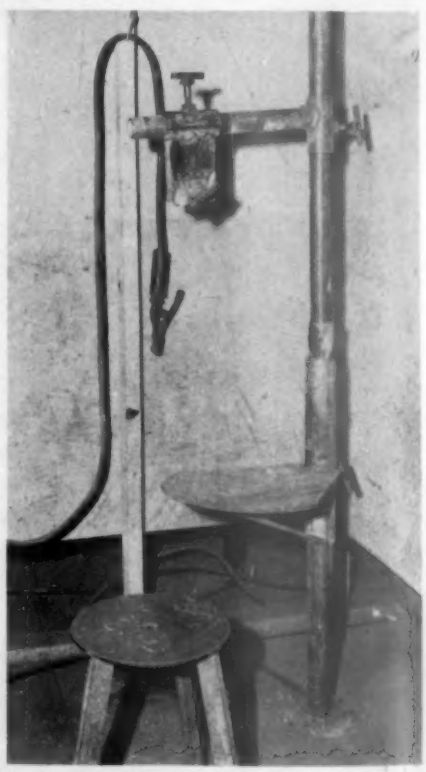
The guide attachment shown in the accompanying illustration was fastened to the cutting machine and set on the I-beam. The cutting torch must then follow the contour of the beam since it is held in place by the guide. The attachment thus prevents the cut from getting out of alignment should warpage in the beam occur.



Weldor Training Table

By James L. Redmond

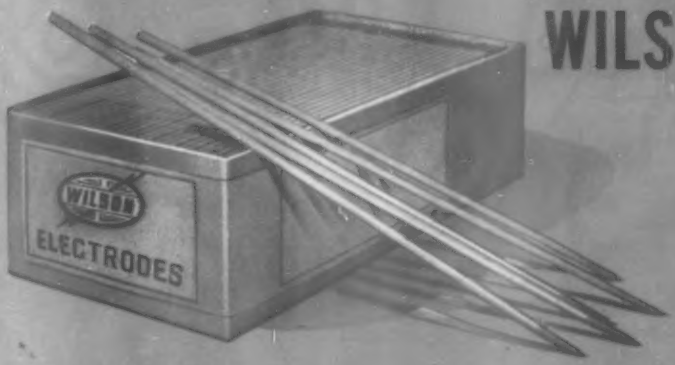
A WAR PRODUCTION Drive Award was given to me for the design of compact, adjustable tables which greatly simplified



Adjustable table for training weldors to weld in all positions and on both plate and pipe.

"TOPS" for every AC welding need

WILSON AC ELECTRODES



WILSON No. 530
(AWS-ASTM E6011)
For highest quality all-position AC welding of mild steel.

WILSON No. 105
(AWS-ASTM E6020)
For single pass, horizontal fillet welding of mild steel, manganese steel, and high tensile steels.

WILSON No. 851
(AWS-ASTM E6030)
For high-speed multiple pass, flat position welding of mild steel.

WILSON No. 107
(AWS-ASTM E6012)
For single or multiple pass welding of mild steel where fit-up is poor.

WILSON No. 108
(AWS-ASTM E6012)
Has same general characteristics as Wilson No. 107 but has a higher rate of deposition.

WILSON No. 520
(AWS-ASTM E6013)
For general purpose welding of mild steel.

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the problem of training weldors at the Marinship Corp. welding school. One of these tables is pictured in the accompanying illustration (page 50). Note how little room it takes up in the welding booth.

The adjustable feature makes it possible to train a weldor for all positions of welding—and for both pipe and plate. The trainee is taught to weld in a flat position when the table is as pictured. By adjusting the table and using clamps to hold the work, vertical, overhead and horizontal positions can be secured. By using the extension arm shown in the top of the picture, the trainee may also be taught all positions of flange and pipe welding.

» «

Flame-Cutting Table

By Charles Apacki

Maintenance Welding Foreman,
R. G. LeTourneau, Inc.

WE WERE badly in need of an oxy-acetylene cutting table in our maintenance welding shop: one which would let us cut out repair parts and shaped pieces and even cut clear across the plate without moving the piece or ruining the table.

Having some short scrap ends of tubing left over from various manufacturing operations, we took nine pieces of 9 in. tubing, cut them each 18 in. long and set them up on end on a flat surface. Then we tack welded them all together, three each way, into one unit (see top picture).

Using some scrap ¼ by 2 by 2 in. angle iron, we made a square frame (bottom picture) and welded on it legs consisting of four pieces of pipe 2¼ in. in diam by 18 in. long. The pipe unit previously described was then set into the frame, giving us a cutting table 27 by 27 in. by 36 in. high. The size, of course, can be optional; the more pipe, the bigger the table.

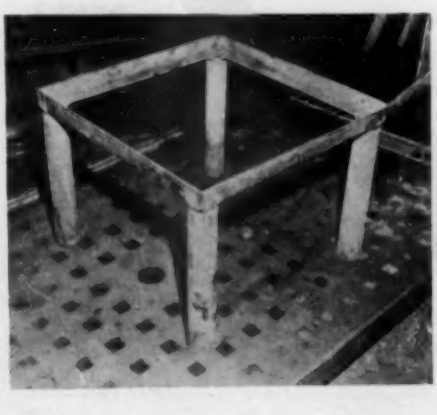
When the top of this table gets rough and cut up from use, it is only necessary to turn the pipe unit over to have a new surface. When this, too, gets rough, we can cut 2 in. off of the end of each pipe and tack weld the pipes together again for several more months of service.

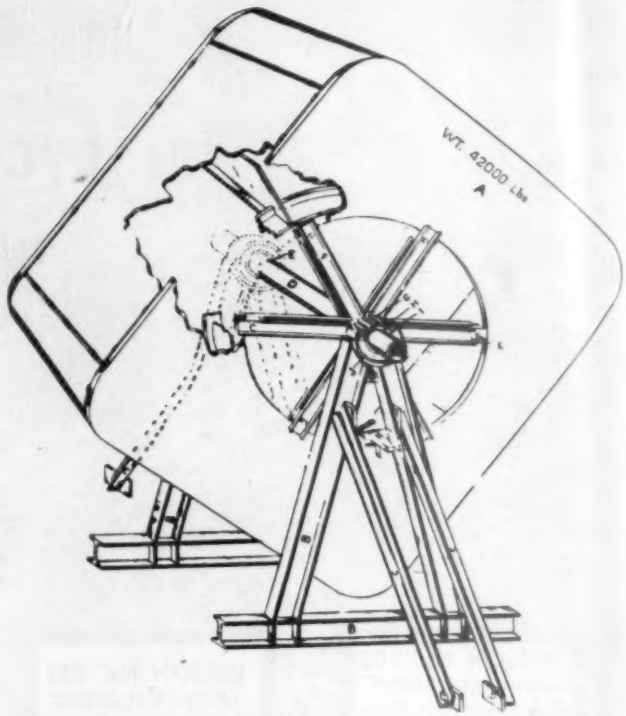
The table is clog-free, and scrap and slag can easily be removed from under it with a shovel. It is also safe for the weldor, because the pipes guide the sparks and slag straight through to the floor.

The material cost amounted to only $2.31; labor, $4.95; total, $7.26. Without welding, the cost would have been prohibitive.

Photographs, Courtesy Hobart Brothers Co.

The nine 18 in. lengths of 9 in. tubing shown above provided the "table" for heavy plate to be flame-cut. The pipes were placed inside the framework below.





A positioning jig for welding cruiser handling rooms. A—tack-assembled handling room; B—frame supports of 8 in. 15 lb I-beams; C—braces of 4 by 4 by ½ in. angles; D—shaft of 6 in. diam, double extra heavy pipe; E—hole cut for shaft; F—spider of 6 by ¼ in. channel; G—1 in. cold-rolled rollers; H—inner race ring, 1 by 4 in. mild steel bar, machined; I—outer race ring, 1 by 4 in. mild steel bar, machined; J—cage retainer ring, ¼ by 1½ in. mild steel bar; K—locking clamp; L—¾ in. bolts.

» «

Jig for Prefabrication

By R. B. Brown

IN THE building of prefabricated units for ships, considerable crane service is required. As a result, much time is lost in waiting for a crane to position or move a large prefabricated unit. For example, in the building of cruiser handling rooms at Bethlehem Ship, San Francisco, it was found that approximately 12 hours of crane service were required for positioning these units. In addition, 4 to 6 men were standing around while waiting for the crane. If crane service could be eliminated, it was believed that overall welding output would be increased by 60%.

For positioning of this 21 ton structure, I designed a jig which eliminated all need for a crane. This design suggestion was accepted by the War Production Committee, and the unit is now built in a positioner in a manner similar to that shown in the accompanying sketch.

After its many pieces are mounted on this positioner and tack welded together, the cruiser handling room may be rotated at any angle to permit the finish welding to be done in the downhand position. Since it is not necessary to use a crane in connection with this positioner, the entire welding operation may be carried out in a closed building. Thus any unnatural conditions that might arise because of atmospheric temperature changes are prevented. An anti-friction bearing makes it possible for a weldor to rotate the unit by simply shifting his weight to one side of center. Locking clamp "K", which is clamped from the inside, will lock the unit in the desired position for welding.

» «

Alignment Jack

By Harry H. Halonen

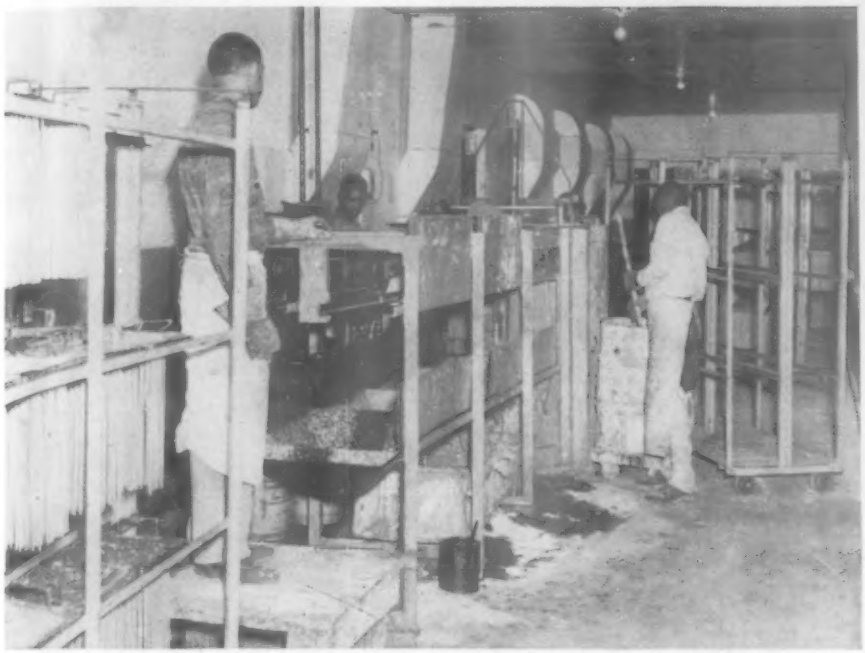
AT NORDBERG Manufacturing Co., we have always experienced considerable trouble in aligning joints for welding, particularly exhaust headers, elbows, etc. It was common practice to do this by having a weldor crawl inside the pipe with a hydraulic or screw jack. This "inside man" did the difficult task of getting the different sections in line, after which he crawled back out and tack welded the joints into position. With most large pipes, this procedure had to be repeated 4 to 7 times. Finally, after everything had been aligned and tacked, it was necessary for him to go back inside the pipe again and bring the jack out so that the finish welding could be done.

I devised an extension jack which would do this job much easier by eliminating the necessity for the weldor to crawl inside the pipe. I submitted the idea to the War Production Drive Committee; it was accepted, and I received an award. The use of this new jack greatly reduces the time lost in lining up and permits the weldor to use his time more profitably for welding operation. It is estimated that each jack in use saves approximately 950 hours per year on these pipe welding jobs.

On the Job

Air-Conditioned Electrodes

AIR CONDITIONING—believe it or not—increased both the quantity and the quality of the stainless steel electrodes produced at the Paschall plant of the Arcos Corporation, Philadelphia. The system—specially designed for Arcos by Carrier Corporation engineers—provides uniform air velocity at specified humidities and temperatures to speed drying of the four coatings on each electrode.



The stainless steel wire is straightened and cut into rods, which are loaded into clamps (left) and dipped in the flux coating. The clamps are then loaded onto trucks (right) for delivery to the drying tunnel.

In the plant procedure, coils of stiff stainless steel wire are fed into a straightening and cutting machine which delivers rods 14 or 18 in. long. These are loaded into clamps (right of accompanying picture) and dipped in a flux paste. The clamps holding the freshly dipped rods are then loaded on a truck and wheeled into one of the company's two drying tunnels.

The above dipping and drying sequence is repeated for each of the remaining three electrode coatings. During the first three drying times the electrodes remain between one and two hours in the tunnel, in air of 76 F and 58% humidity. The final drying takes from eight to ten hours in air of 92 F and 23% humidity.

The needed low-dew-point air (dew point, the temperature at which dew begins to form, varies with the humidity of the atmosphere) is provided by air-conditioning equipment including a water-cooled refrigerating machine. The drying tunnel installation uses ejector nozzles for air distribution, in order to provide a uniform atmosphere throughout each space of the two-stage drying tunnels.

Schenectady Remodeled

REMEMBER the S. S. *Schenectady?* The tanker which gained so much notoriety by breaking in two upon completion of its trial run later gained an equal fame by its remarkable return to service after the break up. The two halves were towed to dry dock and welded together to make a tanker as staunch and seaworthy as any shipyard has turned out.

The *Schenectady* is again in dock, as the accompanying picture shows, but this time not for failure. The tanker is now receiving a deck cargo superstructure which will permit planes, trucks and jeeps to be lashed to her deck to supplement her regular petroleum cargo.

U. S. Maritime Commission Photo.

Restored to useful service by welding, the S. S. Schenectady is being refitted with a deck cargo superstructure.

Welded Loading Runway

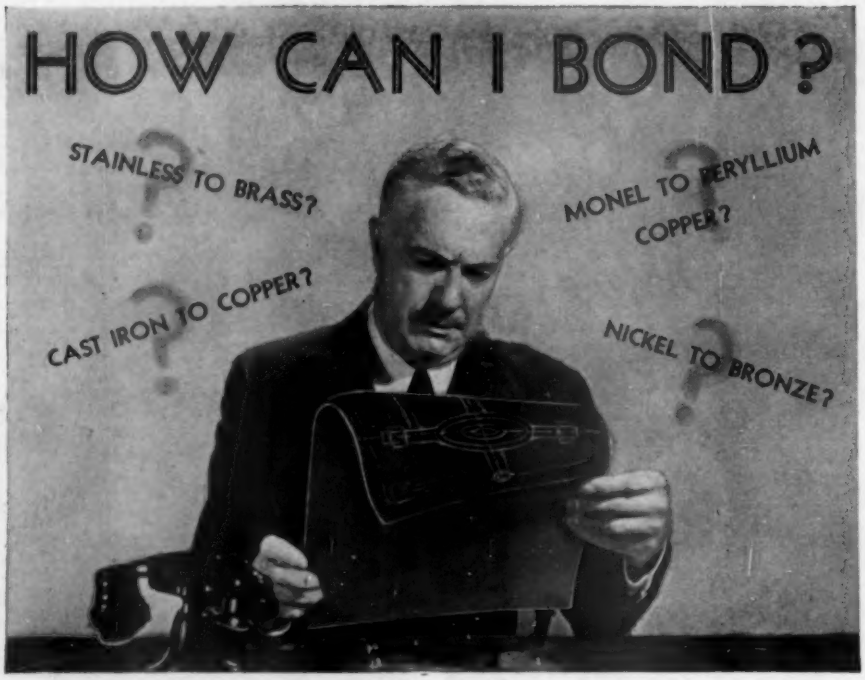
By *Charles C. Lynde*

THE USUAL skidway between warehouse loading platform and freight car was never at hand when emergency shipments were being handled, so the weldor for one company decided to provide a drawbridge that would span the gap. He cut a section of ¼ in. steel plate for a platform, welded webs of 2 in. bar stock across it in both directions to add stiffness with minimum weight, and fitted one edge of the plate with eyes to serve as hinges.

This welded platform may be swung downward to rest on the floor of a freight car when loading or unloading.

This platform was designed to open downward until it rests on the floor of the freight car. When raised, it is held in a vertical position by a flat steel dog pinned to the warehouse door post.

The hinged platform is always at hand, will support any load desired and in its vertical position blocks the shipping opening when there is no freight car at hand.



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NU-BRAZE Flux

Fully active at 900 F. (many degrees below active temperatures of ordinary fluxes). Here is a low surface tension flux, developed after years of experimentation. Meets all government specifications. For a *completely* satisfactory job, use NU-BRAZE FLUX, with NU-BRAZE, the easy flowing, low temperature, silver brazing alloy.

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SPEAKING OF BONDS—The Best Are U. S. WAR BONDS

Weldor's 10-Point Code

By M. E. Vaughan

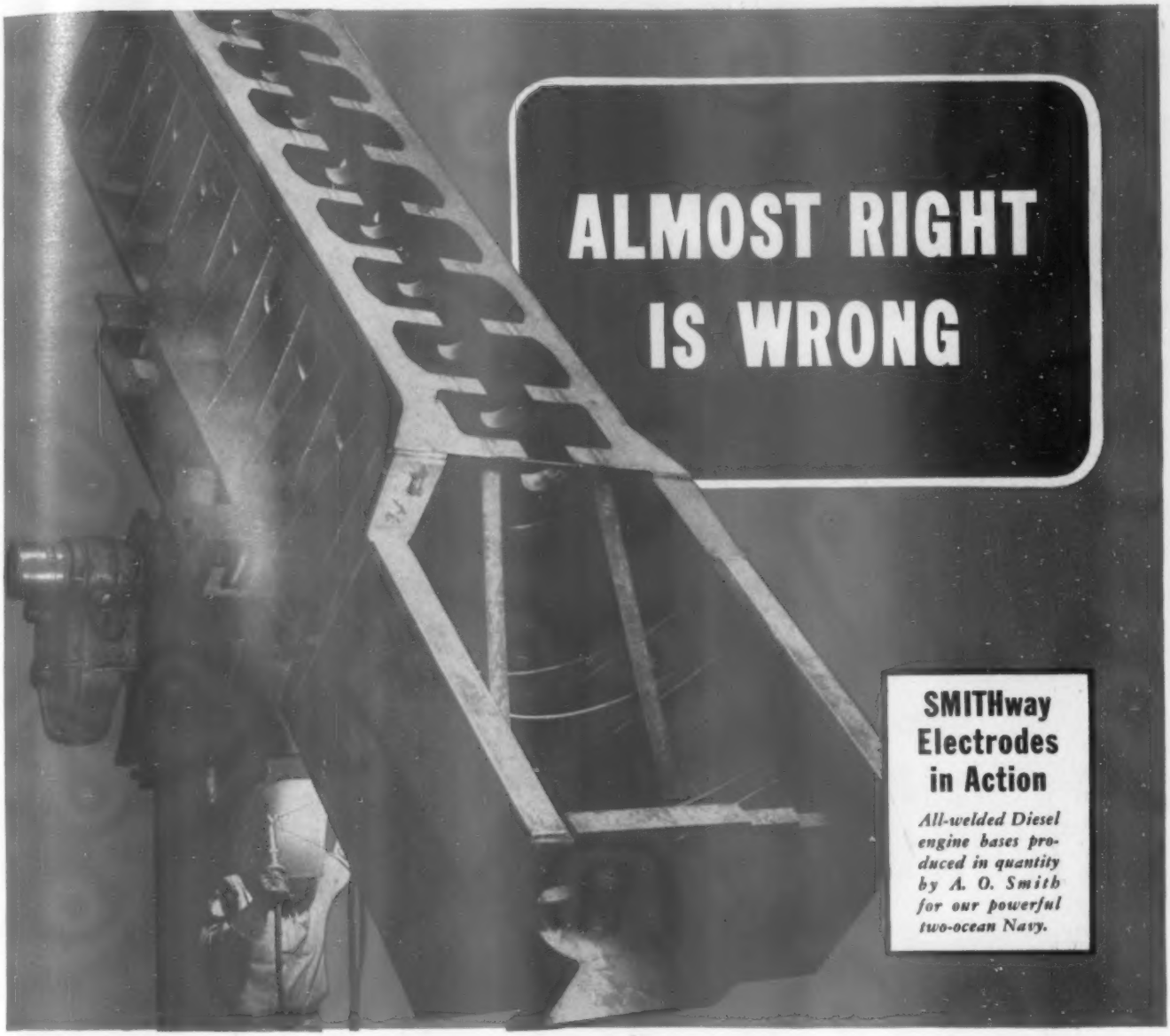
1. Know what kind of metal you are welding before you start to work on it.
2. If you don't know how to weld a certain metal, don't ask a non-weldor how he wants it done. If you, a weldor, don't know what to do, how can he?
3. Never weld anything in a hurry. If someone comes to you and wants a weld put on just "so it will hold," think, brother, think! If it fails, is he going to say it was his fault or the weldor's?
4. Welding engineers are necessary people to have around, just the same as weldors. Some weldors forget this, and so do some engineers. Book knowledge goes hand in hand with practical work. Good weldors know it, but poor ones don't.
5. Try out all new ideas that come along, even if you don't agree with them. You will benefit by what you learn, no matter whether the original idea proves good or bad.
6. Have on hand a good supply of up-to-the-minute reading on welding. It helps you to keep up to date with an industry that is whizzing along like a Flying Fortress.
7. Use up your rods. If you ever have a shop of your own, you will find that long stubs throw profit on the scrap heap.
8. Help that green man. It's the decent thing to do, and besides he may help you. Even oldtimers find that they can sometimes learn a trick or two from a greenhorn.
9. Never allow yourself to think for one minute that you know it all. "He that knows not and knows not that he knows not is a fool; shun him," reads the old proverb.
10. Never knowingly lay down a poor weld: to do so is a betrayal of every honest and conscientious weldor in the whole industry.

Courtesy, General Electric Co.

Defective steel castings are touched up by a-c welding at this Pennsylvania foundry.

Repairing Steel Castings

BIG STEEL castings are rendered serviceable by arc welding at the Pennsylvania Electric Steel Casting Company, Hamburg, Pa. These castings cannot readily be positioned for downhand welding. With the development of the all-position a-c electrode, however, it was found that the work could be conveniently done with 500 amp a-c welders. Results are said to equal those obtained with d-c welding, and the welding speed has increased an average of 10%.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IS WRONG
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WHEN you are up against the "buzz saw" of important service, you want electrodes that have been proved practical by shop experience—backed up, of course, by sound research and engineering.

SMITHway Certified Welding Electrodes are reliable *production tools*, thoroughly proved by day-to-day application in our own shops. With us "Almost right is *wrong*." We must have dependable *quality*, dependable *uniformity*, and the right *operating characteristics* in the electrodes we use. "Almost right" is not good enough. That's why we make the welding electrodes used in our own plants.

Since there isn't any kind of arc welding we don't do, and since there are many kinds of arc welding done only in our shops, SMITHway Certified Welding Electrodes are *proved* in every type of arc welding operation. That, we believe, assures *better welding results* in your shop. We know it does in ours.

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. . . but not too difficult for Cortland. It's just a matter of the right wheel for the right job . . . and Cortland has wheels for Weld Grinding in all types and sizes.

Cortland Resinoid bonded wheels are recommended for portable machines running up to 9,500 S.F.M. You may need several types of different specifications for all your weld grinding. Cortland Engineers will be glad to survey your requirements and suggest a minimum assortment to provide better weld removal with longer wheel life — and the finish required.

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For better Weld Grinding

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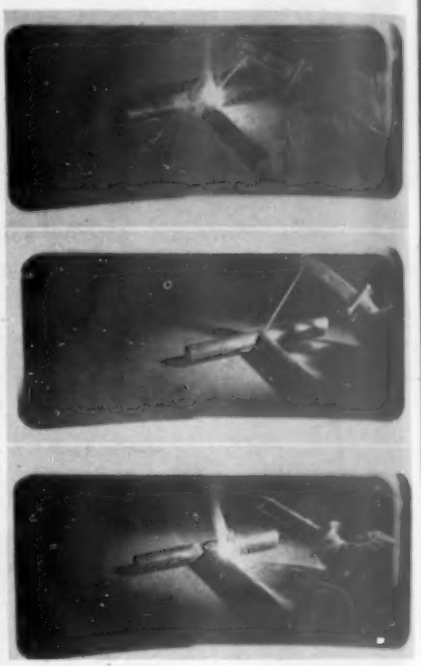
CORTLAND

Lamp Cuts Welding Time

NO LONGER is it necessary for a weldor to raise his hood between each weld in order to position the electrode properly. A new lighting system to speed the welding of airplane parts and other war equipment has been developed by Research Engineer A. B. White, welding expert for the Westinghouse Electric and Mfg. Co. A powerful light is focused on the part being welded, enabling the weldor to see through the lens to the work at all times.

What the weldor sees through his dark-tinted lens is illustrated by the accompanying three views. In the upper picture,



What the weldor sees through his lens. Top: with the arc only; center: without arc when newly developed lamp is used; bottom: with arc when lamp is used.

the arc provides the principal light source for welding. Naturally, the weldor is blind when the arc is extinguished and must raise his hood before he can restrike the arc. The arc glare, moreover, makes it very difficult for him to see what he is doing, even though the light from the arc may be adequate.

The center view shows how easily the weldor can see through his dark lens when there is no arc and the lamp's brilliant beam is used to illuminate the work. The bottom view shows the arc as it appears when the lamp is used; the surrounding brightness is apparent, and the arc glare has been effectively minimized.

Use of this lamp is said to result in a 20% saving in welding time on most jobs plus considerably lowered losses in the spoilage caused by touching the electrode at the wrong points on the work.

HOW ABOUT sending us some of your own ideas for "On the Job"? Just a few words and a photograph will do the trick. Payment will be made at our usual rates. Address: Editorial Department, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.

PAGE *Welding* ELECTRODES

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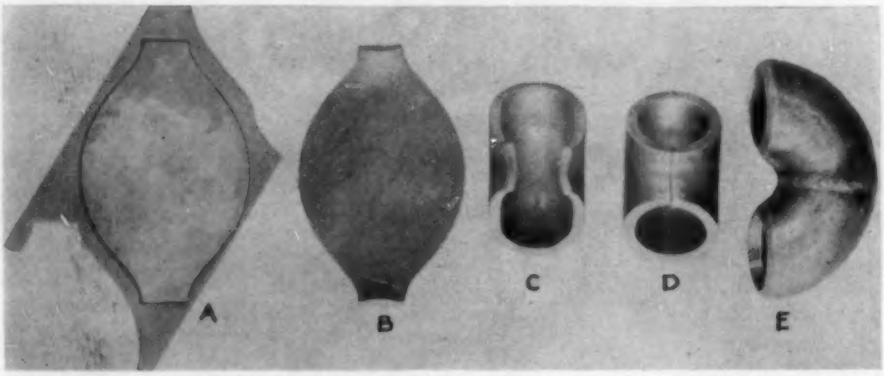

Courtesy, The Hobart Brothers Co.

A—Manner of nesting; B—blank; C—partially formed elbow; D—elbow completely formed and ready for welding; E—return bend fabricated by welding two elbows circumferentially.

Welded Return Bends

RETURN bends for special pipe fittings on Liberty ships and tankers are made in five stages at the Weber Showcase & Fixture Co., Los Angeles. The blank is first stamped from ¼ in. plate, formed cold and rolled into an elbow as shown in "D" of the accompanying illustration. Two of these elbows are then placed in a jig and rotated while they are being welded by a stationary automatic welding head. The edges are chamfered on an automatic machine.

The elbows are 1 and ½ in. ID and are bent on a 3 in. center, making a very short throat. They are all tested hydrostatically at 500 psi.

» «

Package for Hitler

THE 4,000 lb block-busters that are softening up Hitler-held Europe for the coming all-out invasion measure about 8 ft long by 9 ft in circumference. These two-ton

Courtesy, The Lincoln Electric Co.

It's good-bye to Mr. Hitler if one of these babies (we don't mean the girls) ever lands on Berchtesgaden.

monsters are arc welded inside and outside in a total welding time of around 8 hr—a feat possible only because of the employment of labor-saving jigs and positioners.

The various parts are flame-cut and beveled on the first jig, then cold formed to diameter, fitted and tack welded on rolls specially made for this purpose. A power-operated positioning fixture tilts and rotates the assembly while the beads are being laid to seal the leak-proof casing. All welding is done with ⅞ and ¼ in. coated electrodes of AWS specification E-6012. The two rolling bands (see illustration) are hinge-pinned over the lifting lugs.

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- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as, NOT necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents.)* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

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Screw-in type (for removable inlet stems, ¼" std. pipe)	5.00 ea.
Also made for all types of couplings to fit *MEDICAL* regulators	7.00 ea.

See your distributor or write—

Safety Shock Manufacturing Co.
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Did you ever list all the GOOD POINTS you've wanted in a WELDING CABLE?
Shock-resistance • Abrasion-resistance
"Kink"-resistance • "Flex"-resistance
Heat-resistance • Cold-resistance
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Insulation-resistance (dry or wet) Electrical overload protection
Here are some of the characteristics that are carefully checked in the manufacture of Belden Welding Cable. The result—a tough, durable all-purpose cable that can "take it." It means fewer replacements—more hours of service.
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Belden Welding CABLE
Awarded the U.S. Treasury Special Citation of Merit for Initiating the War Bond-or-Cash Dividend Plan

YOU HAVE A TOGGLE C-CLAMP WITH

GREATER STRENGTH

LIGHTER WEIGHT

Added strength has been given this clamp (Model 505) by forging, which also permitted the redesigning to effect a reduction of 17% in weight.

Throat capacity was increased where it was most needed. The clamp now possesses better balance which makes for easier handling. A wing nut supplants the knurled head to facilitate original adjustment.

Once adjusted for required thickness, clamp remains at that setting for repeated clampings. No screwing or unscrewing necessary.

KNU-VISE INCORPORATED

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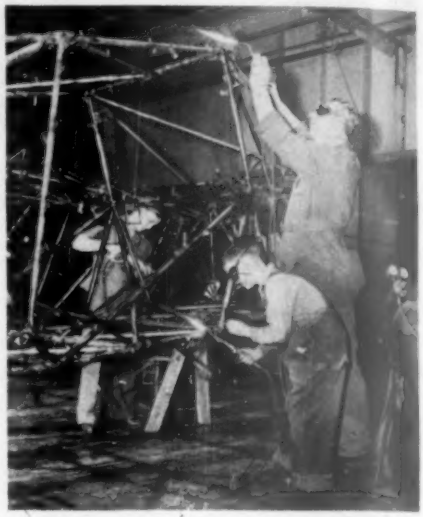
Big and Little Weldors

LILLIPUT and Brobdingnag work together in harmony for the welding of aircraft fuselages at the Howard Aircraft Corporation's Chicago plant, where Howard Nightingale ambulance planes are built. Myron E. Johnson, who is 4 ft 6 in. tall and weighs 65 lb, takes the low welds and 6 ft 3 in. "Man Mountain" Zapotocky, a former professional wrestler, takes the high ones.



Acme Newspictures, Inc.

The little welder is 27-year-old Myron E. Johnson; the big one "Man Mountain" Zapotocky, a former professional wrestler. Helen Brown is the name of the young lady in the background.

It would be just as difficult for the big fellow to stoop all day long as it would be for the little man to reach the upper portions of the structure. Together, however, they can do both jobs.

» «

Repairing Motor Blocks

By *L. E. Kunkler*

President, Metallizing Company of America.

THE REPAIR of cracked cylinder blocks is a new application of electric bonding, an arc-welding process originally developed to fuse a rough deposit of electrode metal on a surface in preparation for metallizing. The detailed procedure is as follows:

Using a ⅛ in. round nose cape chisel, the operator cuts a groove from ⅛ to $\frac{3}{16}$ in. wide and the same distance deep down the middle of the crack. The groove should have a square shoulder on each side and must be cut at least ¼ in. beyond the end of the crack. Care has to be taken in order not to chisel through the wall.

With a narrow V-pointed chisel, the operator next compresses the metal into a further groove down the middle of the crack. Thorough tapping must be done.

The crack is now ready to be bonded. An electrode of pure nickel is used with the highest possible heat setting of the bonder and an air pressure varying from 20 to 40 psi.

The nickel rod should extend not less than 1 in. nor more than 1½ in. out from the holder. It is held in contact with the surface for a few seconds until it gets red hot from

In the repair of cracked blocks by the electric bonding method, bonding is accomplished by depositing an electrode of pure nickel.

½ to ¾ in. back. This is the proper condition for bonding, but the rod must not be allowed to get too hot or lumps will come off instead of the fine, dense deposit desired.

A layer of nickel is laid in the bottom of the groove by moving the electrode slowly across the surface with a motion similar to that employed in striking a match. After sufficient nickel has been deposited to seal the crack, the metal is peened lightly with a center punch that has been ground down to almost a round point.

A little different procedure is used to fill the crack, though the settings and air pressures are the same. The electrode is held at an angle of 45 deg and passed slowly over the cracked area, which is allowed to fill up as the rod is drawn towards the operator. The crack should be completely filled in one pass, but this will require experience on the part of the operator.

With the terminal control set to a lower heat and the air pressure reduced to 20 psi, the electrode is now rubbed over the nickel deposit. This condenses the nickel into a more solid mass and helps to fill in porous spaces.

A hand grinder with a small mounted wheel shaped according to the location and accessibility of the crack is used to finish the bonded deposit to the original tolerance. For best results, valve seats should have inserts, and cylinder walls should be sleeved.

The use of a colloidal solution is recommended to eliminate any traces of porosity remaining in the deposited nickel. This solution contains suspended metal particles, including chrome, that are about 0.0005 in. in diameter—so small that they will enter pores into which even water cannot pass. When the colloidal solution is allowed to permeate the pores, the minute metal particles will coagulate and completely fill the tiny cavities.

One quart of the above solution is put into the radiator with four gallons of water, and the motor is run for about half an hour, which is sufficient to allow the colloidal material to penetrate throughout the microscopic structure. Solution and water are then drained; the radiator is refilled with fresh water, and the motor is ready for use.

Cracks in aluminum cylinder heads may also be repaired by following substantially the same procedure. An electrode of pure aluminum is used instead of nickel, and higher air pressures are usually desirable.

Oil Quench *Increases* *Hardness* of Welded Dies . . . . . .

A welder in one of the plants of a rubber company was having difficulty in obtaining the requisite hardness when reclaiming worn dies with Amsco Dieweld, using the atomic hydrogen process. On some of the dies the hardness was as low as 22 Rockwell C, which was hardly adequate, as the dies are used to stamp out cups which hold machine gun bullets.

However, as the welder got the knack of operating his equipment and quenching the dies in oil was tried, an average hardness of between 50 and 53 Rockwell C was obtained. The management is reported to be well satisfied with these results, as the dies cost $175.00 each, and 80 of them have been reclaimed with the use of approximately three pounds of 3/32″ rod.

Dieweld was developed for repairing dies, trimmers and punches; for making composite dies; for restoring the worn edges of shear knives and other cutting tools, and for tipping on a cutting edge on ordinary steel. This cold drawn, heat-treated rod contains chromium, molybdenum, iron and carbon essentially, and other elements to a minor degree. It air-hardens as welded, responds to heat treatment, and can be made machinable by ordinary tools. After machining, it can be rehardened, and various degrees of hardness together with the desired toughness may be obtained.

The oil quenching referred to above may be helpful to others engaged in similar reclamation work.

A number of cases have been brought to our attention where Dieweld has aided the war program. It is being extensively used to restore the worn cutting edges of milling heads, reamers, cutter bars and shearing blades.

Many cutting tools, dies, knives and punches formerly made of tool steel throughout are now frequently made of mild steel and the actual cutting edge—usually a small portion of the entire tool or blade—tipped on, using Dieweld. A bulletin, No. 742W, describes some of these applications.

Amsco Dieweld is available in 5/32″, 1/8″, 3/16″ and 1/4″ diameters as bare welding rods for gas and atomic hydrogen welding or coated electrodes having excellent welding qualities on both D.C. and A.C. welding circuits.

Amsco

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois

AMERICAN Brake Shoe COMPANY

FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

New Products to Use

Aluminum Spot Welder

1 A rocker-arm spot welder for heavy aluminum aircraft sections is announced by **Progressive Welder Co.** The new Model "C" will handle "structural" aluminum sections up to ⅛ in. Alclad and has been designed for a conservative production rate of 1,000 to 2,000 spots per hour. Throat depth is adjustable from 36 to 42 in. and throat opening from 7½ to 17½ in. Controls are provided for three different pressure conditions: normal welding pressure, forging pressure and light pressure for tip dressing.

The upper and lower arms are designed for standard spot-welding electrodes and holders, though refrigerated welding points may be used if desired. The electrodes may be mounted either vertically or at a 22½ deg angle—a position not recommended if the machine is to be operated at or near maximum pressure. The welder is rated at a maximum point pressure of 6,500 lb (at 90 lb factory air line).

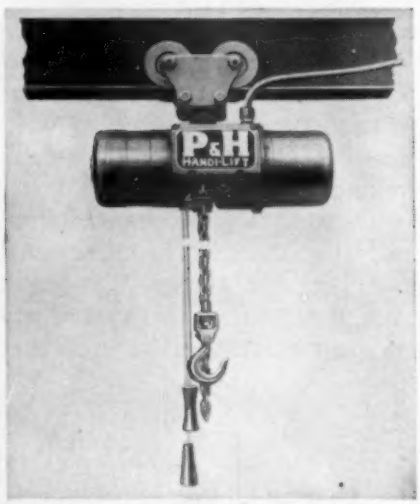
Progressive Model "C" spot welder for heavy "structural" aluminum aircraft sections.

» «

Chain Hoist

2 A low-price electric chain hoist rated at 500 lb has been developed by **Harnischefeger Corp.** This small "Handi-Lift" introduces many new features. Loosening of only one bolt permits a quick change-over to bolt, hook or trolley mounting. In trolley service, the hoist can be suspended either parallel or crosswise to the beam. Fully enclosed, it may be used under any condition of weather, dust, moisture or acid fumes. Operation is by a convenient pull cord actuating a lever toggle; this arrangement leaves the operator with one free hand to guide the load. Dual braking is provided by a spring-set electric motor brake which automatically releases when hoist is operated and sets with the shut-off current.

IF YOU wish additional information on one or more of the items described in THE WELDING ENGINEER'S New Products section, please use the coupon appearing below. Simply write in the numbers of the items which interest you, sign your name and address and mail coupon to THE WELDING ENGINEER.



P&H "Handi-Lift" 500 lb chain hoist.

» «

Electrode Holder

3 Constructed of solid copper alloy with a removable fibre handle, the new "Greyhound" electrode holder is said to offer the advantages of light weight, durability, firmly gripping jaws and a quick release of stub ends by means of a thumb-operated lever. Its eight models provide for current capacities of up to 500 amp, for electrode diameters from 1/16 to 3/8 in. and for either a solder connection or a clamp-type mechanical connector. All insulated models possess Arcite insulation. **Greyhound A.C. Arc Welder Corp.**

» «

Plastic Safety Goggles

4 Two new AO goggles of lightweight acetate plastic have been brought out for the "metal-allergic" worker whose skin is unduly sensitive to metal goggle frames. Spark-proof, they are suggested for use in powder plants, oil refineries or certain chemical plants where the tiniest spark can cause fire or explosions.

One of the new goggles has a pink crystal frame with white or Calobar 6-curve "Super Armorplate" lenses. The second goggle is fitted with side shields and comes in a pink crystal with white lenses or in a green color with Calobar lenses.

These goggles are said to have a stronger, more massive front than ordinary acetate goggles patterned after zylonite spectacles. The groove in the lens rim is deep; the bridge is made of extra heavy stock, and nose pads have well rounded edges and ample flare to withstand jolts and blows. **American Optical Co.**

"Ful-Vue" goggles. Made wholly of lightweight plastic, they may be safely worn where even a tiny spark would cause a disastrous explosion.

Editor, THE WELDING ENGINEER, 506 So. Wabash Ave., Chicago 5:
Please have literature sent to me on the following items:
(write in the numbers of those that interest you)

_____ _____ _____ _____ _____ _____

Name ..... **Title** .....

Company .....

Address .....

City ..... **State** .....

Number of Welding Operators in your plant .....

May, 1944

★ VICTOR ★

ARMY (E) NAVY

FROM KEEL TO LAUNCHING PLATE.... We don't claim to build ships but we have proved that VICTOR hand and machine cutting torches are the most economical to own ...They cut faster, have a longer and trouble-free service life and are easier to handle...Thousands of VICTOR cutting torches are doing yeoman service in War Production plants.

Photographs by courtesy of Richmond Shipyard No 2 of The Permanente Metals Corporation, Richmond, California

VICTOR EQUIPMENT COMPANY

844 FOLSOM STREET · SAN FRANCISCO 7

Authorized Distributors and Repair Stations from Coast to Coast

Keller pneumatic file. It delivers 1,500 strokes per minute.

Pneumatic Filing Machine

5 This new pneumatic hand tool, Number 000-F Model 1416, will do finish filing of die casting dies, plastic molds, airplane parts, etc. It can also be used as a portable power saw by substituting a hack saw blade for the file. Tool has a free-speed rating of 1,500 strokes per minute with a fixed length of file stroke of $\frac{7}{16}$ in. **Keller Tool Co.**

» «

Aircraft Welding Torch

6 A new addition to the "Torchweld" line of welding and cutting equipment is a compact welding torch weighing only 8 4/5 ounces. This torch, the "Aircrafter," was especially designed for welding aircraft tubing as well as aluminum and aluminum alloy sheets and plates. It may be used on other sheet metal up to ¼ in. in thickness for precision work in "hard-to-get-at" spots.

"Aircrafter" torch. It weighs less than 9 oz., and tip can be swiveled to any position.

The "Aircrafter" has an overall length of less than 12 in. and a handle ⅞ in. in diameter and 4⅛ in. long. Two styles of copper tips are offered, both producing soft, medium-pointed flames. These tips are of the screw-in style and can be swiveled to any position. Tip head is made of heat-resistant cupro-nickel, while mixer incorporates the patented Torchweld "non-flash" principle. **National Cylinder Gas Co.**

» «

To ground crew men this is the signal that means . . . O.K. . . . Perfect. If welders were to borrow the hand signals of flying this is the one they'd use for the sweet, smooth performance of MARQUETTE A.C. Arc Welders.

It describes "to a tee" the superb job that these versatile machines do on all types of metal fabrication or repair.

LOW INITIAL COST • NEGLIGIBLE UPKEEP • LOW OPERATING COST • FAST, FLAWLESS WELDS • ALL ASBESTOS INSULATION • STURDY CONSTRUCTION • HIGH POWER FACTOR • LOW IDLING COST • 10 MODELS, 125 to 400 amps. • COMPLETELY EQUIPPED

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MARQUETTE MFG. CO., INC.
Minneapolis 14, Minn.

MARQUETTE
REGISTERED U.S. PAT. OFFICE

a.c. arc welders

Backless welding coat. Inset at lower right shows how it appears from the rear.

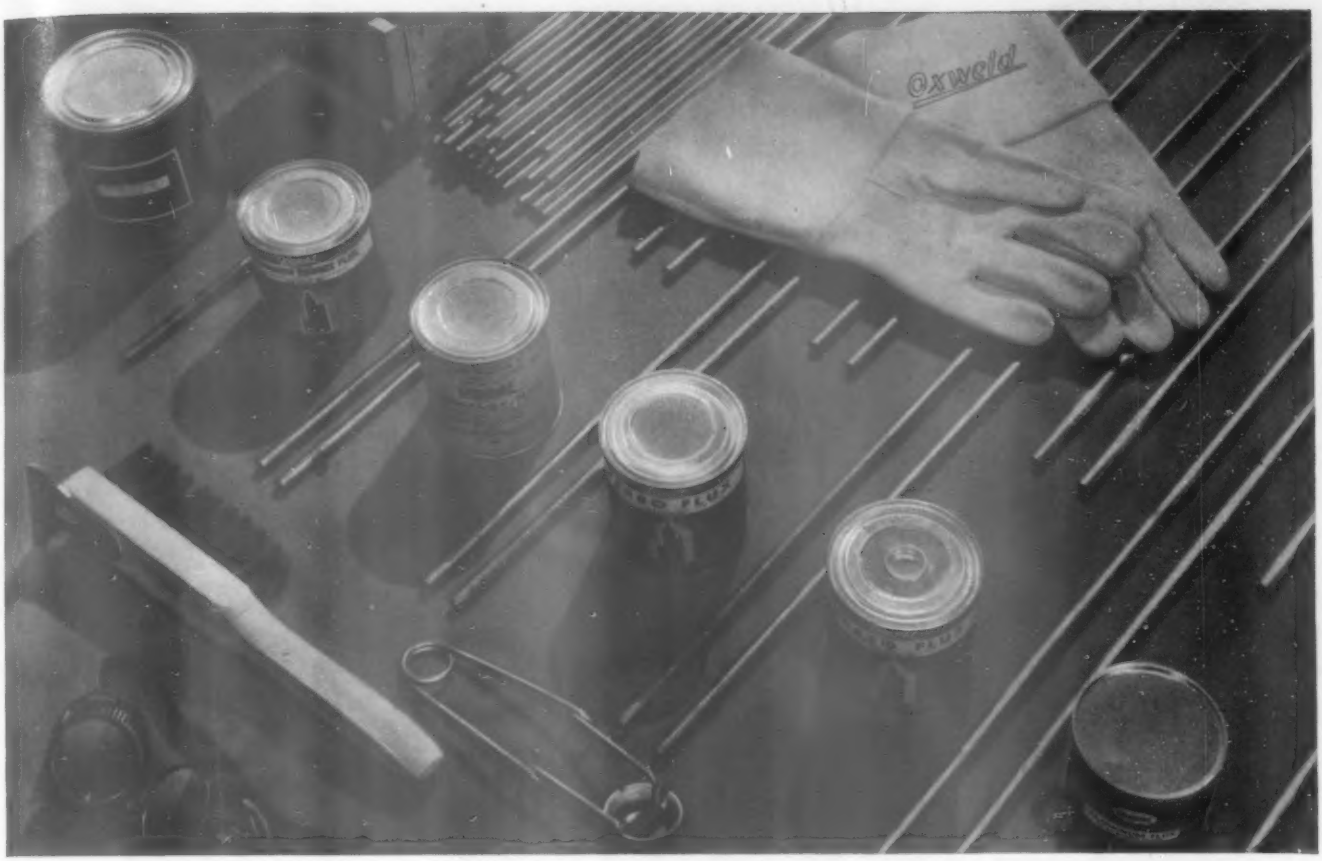
Backless Coat for Women

7 A backless coat for women weldors has been introduced by **Fred Jessar**, manufacturer of "Saf-T" garments. This coat combines complete front protection with the advantages of greater coolness and diminished weight. It is made of pliable chrome split leather and is available in pearl grey or tan colors and in small, medium and large sizes. Seams are raised and double-stitched.

» «

Protective Cream

8 A smooth, white cream that disappears into the skin to form an "invisible glove" is a new product announced by **Turco Products, Inc.** "Solu-Gluv" dries to form an invisible film to which grease, paint, cutting oils and dirt adhere and are all rinsed off in ordinary water at wash-up time.



OXWELD OXY-ACETYLENE Welding Rods and Supplies

If this picture suggests supplies that you need, check your requirements on this list. If your jobber cannot supply you, phone or write the nearest Linde office to send them to you.

Oxweld Rods

- ___ No. 1 H.T. (High-Test) Steel
- ___ No. 7 Drawn Iron
- ___ No. 9 Cast Iron
- ___ No. 28 Columbium-Bearing 18-8 Stainless Steel
- ___ No. 32 CMS Steel
- ___ No. 34 Mild Steel
- ___ No. 23 Aluminum
- ___ No. 14 Drawn Aluminum
- ___ No. 15 Cast Aluminum
- ___ No. 25M Bronze
- ___ No. 31T Bronze
- ___ No. 19 CUPRO

Oxweld Fluxes

- ___ BRAZO
- ___ FERRO
- ___ Aluminum
- ___ Cast Iron Brazing
- ___ CROMALOY
- ___ Silicon Bronze
- ___ Aluminum Bronze

Other Items

- ___ OXWELD Welding Goggles
- ___ OXWELD Gloves
- ___ Wire Brushes
- ___ Friction Lighters
- ___ OXWELD Welding Hose
- ___ Hose Connections
- ___ Asbestos Paper

Other Rods

- ___ EVERDUR Bronze
- ___ TOBIN Bronze
- ___ STELLITE Hard-Facing
- ___ HASCROME Hard-Facing

. . .

A descriptive price list of the complete line of Oxweld oxy-acetylene supplies can be obtained from any Linde office.

The words "Brazo," "Cromaloy," "Cupro," "Ferro," "Hascrome," "Linde," "Oxweld," and "Stellite" are trade-marks of Union Carbide and Carbon Corporation or its Units.

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

BUY UNITED STATES WAR BONDS AND STAMPS

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

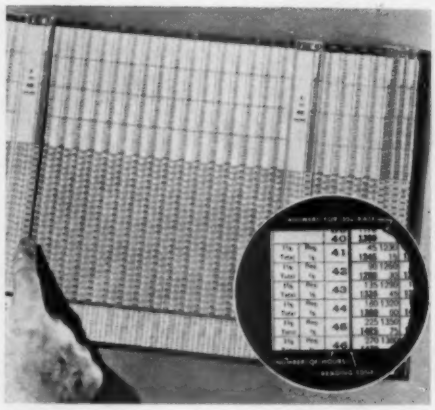
30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

Payroll Calculator

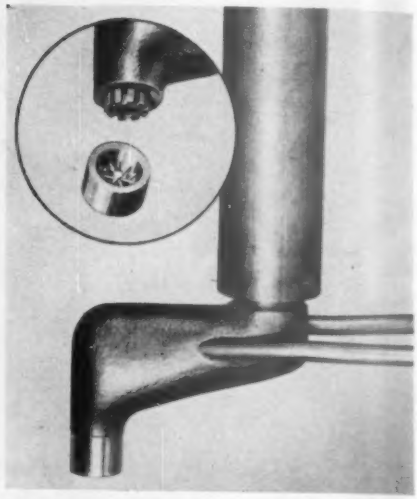
9 The "Wage-Master" payroll calculator automatically computes: (*a*) wages at straight time; (*b*) premium wages; (*c*) wages at time-and-a-half on all over 40 hours and (*d*) total wages earned. There are 234 pay rates ranging from 30 cents to $2.125 per hour, and the time periods vary from 0.1 to 64.9 hours. A separate withholding tax calculator is included.

In the accompanying illustration, the enlarged section at lower right shows a portion of the 30-cent rate column. The four sets of figures to the right of the reading edge (heavy vertical line) indicate time-and-one-half (upper left); one-half time (lower right); regular time (upper right) and total time (lower left), for each hour after 40 hours. **Wage-Master Co.**



"Wage-Master" payroll calculator. Enlarged section at lower right shows a portion of the 30-cent rate column.

» «



"Frostrode" offset electrode installed in a standard electrode holder. Inset shows replaceable "Frostcap" tip and the internal coolant guide.

Tip-Cooled Offset Electrode

10 An offset spot-welding electrode which may be used with a refrigeration-cooling system is announced by **Frostrode Products.** This electrode may also be used with ordinary cooling systems, its chief advantage being that the internal passages are extended clear to the tip. The cooling liquid enters the electrode below the "knee" which the offset type of electrode requires and thence flows through the coolant guide into the finned, replaceable tip. Maximum strength is retained by having a solid cross-section at the point of greatest stress.

This new offset electrode is adaptable to any standard spot-welding electrode holder. It is available with either a 5/8 in., 3/4 in. or 7/8 in. OD replaceable tip or "Frostcap." The latter is available in either hard drawn copper for high conductivity or in Mallory 3 metal for high hardness. Offset distances of from 0 to 4 in. are available.

» «

Refrigerated Electrodes

11 A new line of refrigerated spot-welding electrodes with replaceable "Frostcaps" of Mallory-3 metal is offered for welding operations requiring high electrode pressures. Construction is similar to other types of "Frostpoint" electrodes. The replaceable tip has finned internal surfaces to distribute the coolant uniformly. The new Mallory-3 "Frostcaps" are available in 5/8 and 7/8 in. OD and may be used with any standard or offset electrode of this manufacture. **Frostrode Products.**

Name your toughest finishing job . . . ONE OF THESE SKILSAW TOOLS will do it FASTER, BETTER, EASIER!

• If your problem is grinding down heavy weld beads or removing heavy burrs . . . a SKILSAW Portable Grinder will speed the work. If it's cleaning off spot welds, or polishing curved or flat surfaces of any material . . . one of these SKILSAW Disc Sanders or Belt Sanders will do the job better, and easier!

SKILSAW Disc Sanders, Belt Sanders and Portable Grinders, like all SKILSAW TOOLS, are *built to stand the gaff.* They're powered for extra fast work . . . streamlined, compact, lighter for easier handling . . . and they're *better-built throughout* for trouble-free performance longer . . . at a lower cost.

Ask your distributor for a demonstration of SKILSAW TOOLS on your own work today!

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Sales and Service Branches in All Principal Cities

SKILSAW Belt Sanders • Do all sanding and finishing on flat surfaces of metal or wood. Powerful, rugged!

SKILSAW Portable Grinders • Best tool for grinding down heavy welds, studs. Ball bearing construction.

SKILSAW Disc Sanders • Used with wire brushes, grinding wheels, sanding discs or felt rubbing pads.

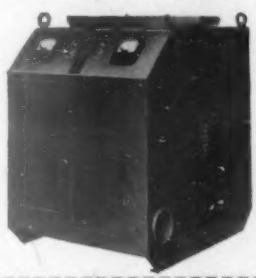
• Planning for After the War? Let Skilsaw Field Engineers help you now to plan "tooling-up" for peacetime production, with Skilsaw's new post-war tools.

SKILSAW PORTABLE ELECTRIC TOOLS
MAKE AMERICA'S HANDS MORE PRODUCTIVE

EXPERIENCED HELP

READY, WILLING and ABLE to work for *You*

● G-R **MANUAL WELDERS** for maintenance, production and general shop use are available in eight standard models, ranging in capacity from the 10-100 ampere Model 10 to the 100-675 ampere Model 49 (sizes to 2,500 amperes included in the "Combination" classification, below). These modern a.c. units deliver a smooth, steady arc that handles easily in *all* welding positions; control is stepless and uniform, efficiency high. All units are available in "C" models, with Power Factor Correction and Class B insulation.



● G-R **AUTOMATIC WELDERS** provide a highly-efficient, accurately-controlled source of power for automatic and UNIONMELT welding heads. Now at work in the nation's leading shipyards and heavy fabrication plants, G-R units have established an excellent record for dependable, low-cost performance. Sizes range from the 400-1000 ampere Model 55 to the 500-2500 ampere Model 88. Power Factor Correction available for all models; Class B insulation is standard.

● G-R **COMBINATION WELDERS** are used for both manual and automatic welding. Wide current range, ease of control, and extremely high efficiency at any load make these ideal general-purpose machines for large shops where requirements vary widely. Capacities range from the 125-1250 ampere Model 65 to the 125-2500 ampere Model 85. Power Factor Correction available for all models; Class B insulation standard.

● G-R **VOLT-O-MATIC CONTROL** assures absolute safety, increases welding production. VOLT-O-MATIC Control can be used with any a.c. welder; it reduces no-load open circuit voltage to less than 10 volts (operators can change electrodes without a "sting" even when it's rainy and wet!). Arc time totalizer accurately records actual arc time... provides a continuous record of output for each welder. Shipyards and others now using VOLT-O-MATIC report production increases up to 20% from this "production control" feature!

SEE YOUR G-R DISTRIBUTOR

If you need help on the "welding front", these performance-tested G-R units are ready to pitch in . . . phone your nearby G-R distributor, or write:

GLENN-ROBERTS COMPANY

1009 FRUITVALE AVENUE, OAKLAND, CALIFORNIA

2107 ADAMS STREET, INDIANAPOLIS, INDIANA

P. O. Box 1814, Washington, D. C.

Refrigeration Unit

12 An air-cooled "packaged" 1½ hp refrigeration unit applicable for the cooling of resistance welder electrodes is announced by the **Airtemp Division of Chrysler Corp.** This new unit, states manufacturer, has ample capacity to cool tips on all types of spot welders, on either ferrous-metal or aluminum welding jobs.

The cooling liquid is contained in an insulated storage tank and circulated by a ¾ hp pump having a nominal capacity of 6 gpm. All of the liquid drains back to the storage tank when motor is shut off. The 1½ hp radial compressor is hermetically sealed, protecting the mechanism against dirt and moisture and reducing refrigerant losses to a minimum.

» «

Mild Steel Electrodes

13 Four new additions round out the "Perfection" line of welding electrodes. Grade P-61 is a heavily coated, general purpose, straight polarity d-c electrode for welding mild steel in all positions. It meets the requirements of AWS Classification E-6012 and is designed especially for fast production where high currents are used and the arc action is strong. P-103 is a heavily coated, all-position a-c electrode which meets the requirements of AWS Classification E-6011 and ASME Par. U-68 and is also suitable for welding low-alloy steels which are used primarily for their high strength properties.

Electrodes P-170 and P-180 are bare and wash-coated mild steel electrodes meeting the requirements of AWS Classifications E-4510 and E-4511, respectively. Both are straight polarity d-c electrodes. **The Anthony Carlin Co.**

» «

Transparent Eyeshield

14 Undistorted and unrestricted vision are claimed for the new one-piece "Plasti-Goggle." Made out of clear

"Plasti-Goggle." The young lady is wearing a one-piece eyeshield of Plexiglas.

Plexiglas—a material said to have the same qualities as fine optical glass—the lens area extends in an unbroken curve from temple to temple without corners or sharp bends. There are no rivets, bars or seams. **Eastern Equipment Co.**

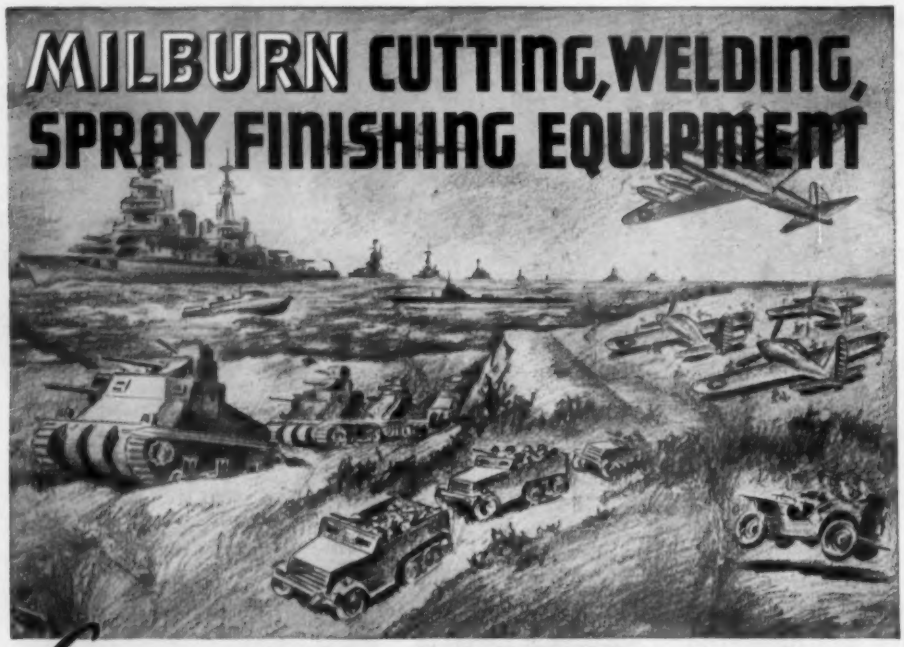
» «

Aluminum-Bronze Electrode

15 Wilson No. 200 is a coated aluminum-bronze electrode which can be used as a high-tensile bronze electrode in metal-arc welding and also as a filler rod in carbon-arc welding. It produces welding deposits said to offer the combined advantages of strength, hot ductility and superior resistance to corrosion.

This electrode has a universal application in the welding of most bronzes, malleable and cast iron or steel. In addition, it is especially fitted for specific applications such as welding manganese bronze conforming to Federal Specification QQ-B-726b or Navy Specification 49-B-3e for marine propellers. It can also be used for welding dissimilar metals—cast iron to brass, steel to malleable iron—provided that the two component metals are weldable with aluminum bronze.

Stock sizes for the new No. 200 electrode include ⅛ to 3/16 in. diam in 14 in. lengths and ¼ in. diam in 18 in. lengths. **Wilson Welder and Metals Co., Inc.**



Geared for **WAR** *today —or* **PEACE** *tomorrow*

Through two wars and for almost half a century, The Alexander Milburn Company has been serving Government and Industry. Milburn Equipment may be relied upon for superior, dependable service under stress of the most adverse conditions.

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1403 W. BALTIMORE ST., BALTIMORE, MD.

Block and Tackle Loads

By W. F. SCHAPHORST

AN ESTIMATE of the load which will be imposed upon the line of a block and tackle may be quickly determined from the accompanying nomograph. This alignment chart takes into account the friction of the ropes and pulleys. Friction, of course, is less for a smaller number of ropes, although the pull on the lead line decreases as the number of ropes increases.

How to Use the Chart

By laying a straight edge across the chart, as indicated by the dotted line, the pull necessary to lift any weight up to 200,000 lb is immediately given in column B.

For example, what pull on the lead line is required to lift 20,000 lb with five ropes?

Solution: The graduation corresponding to 5 in column A is connected by a straight line with that corresponding to 20,000 lb in column C. The straight line intersects column B at approximately 4,700, which is the required pull in pounds.

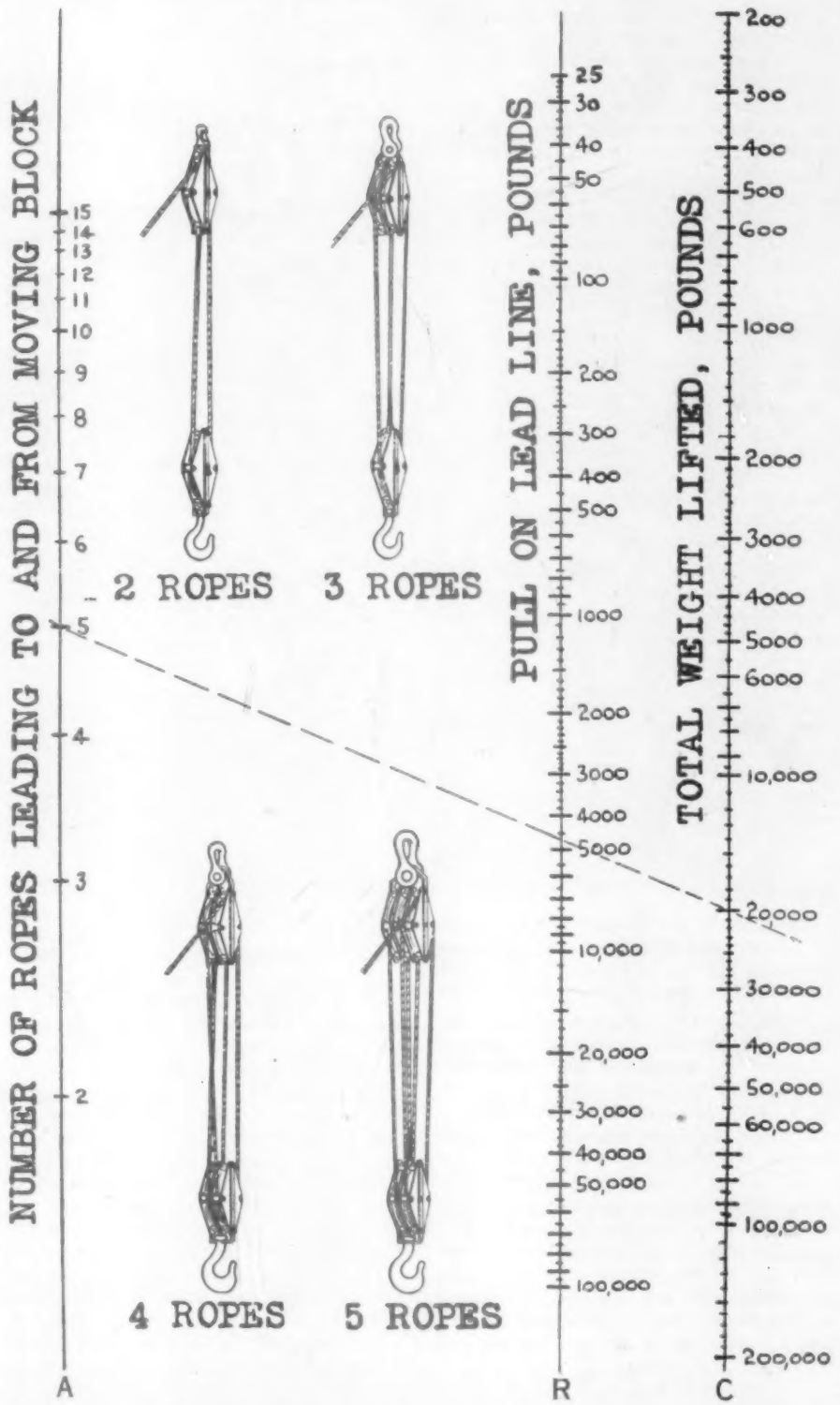
The number of ropes supporting the load and selected in column A is determined by counting the ropes leading to and from the moving block as illustrated by the sketch.

In arriving at the stress in the lead line, the common practice is to divide the weight of the load by the number of ropes supporting it, but this is not correct as it does not take into account the friction of the blocks or the rigidity and internal friction of the rope. When hoisting, the maximum stress occurs in the lead line, since this line, besides taking a proportion of the load on a single supporting rope, also takes the accumulated friction of the blocks and rope in all other parts of the tackle.

If, for example, a "seven rope" hoist is employed for raising a load of 35,000 lb, according to the usual practice the stress in the lead line would be computed as 5,000 lb, assuming that all parts pulled equally. This stress occurs, however, only in the becket line. The maximum stress is 6,325 lb as determined by test. The chart gives that figure very closely, as will be observed.

Although this chart is based on figures that were determined for wire rope tackle, it is also applicable to ordinary manila rope.

It must be remembered, when buying a rope for use in a block and tackle, that the rope must be strong enough to resist the "maximum" pull, which is the pull in the lead line.



The Technical Slant

"Books are the ever-burning lamps of accumulated wisdom"—*G. W. Curtis*

Spanish Dictionary

ENGINEERS' DICTIONARY. *By Louis A. Robb. Published by John Wiley & Sons, Inc., New York City, 1944. Fabrikoid, 5¼ x 8 in., 423 pages. Price $6.*

Some 25 years ago a large engineering organization began to collect systematically the Spanish equivalents of North American engineering and construction terms in order that accurate technical translations might be possible. About eight years ago this company published a small book containing some 5,000 of these Spanish engineering terms. The edition was limited, but the demand for it was tremendous. The display of enthusiasm manifested thus led directly to the compilation of the present volume by Mr. Robb, an employee of the company concerned.

This dictionary includes the Spanish-English and English-Spanish equivalents of the engineer's vocabulary. The engineering terminology of Spanish America, it should be noted, differs from that of Spain, and there is also considerable variation in the use of words among the 18 Spanish-speaking republics. Because of this linguistic variation, local terms are designated by the countries of their origin.

While the book was originally planned to be confined to office and job terms relating to civil engineering, the all-inclusiveness of civil engineering activities made it necessary to include many electrical and mechanical engineering terms and some terminology of geology, chemistry and other sciences. Since welding is playing an increasingly important part in civil engineering and construction, there is also included a complete list of equivalent welding terms.

» «

Metal Work

AIRCRAFT SHEET METAL WORK. *By C. A. LeMaster. Published by American Technical Society, Chicago, 1944. Cloth, 6 x 9 in., 388 pages. Price $3.75.*

Many instructive pictures of actual operations in the shop along with a series of questions and answers at the end of each chapter help to qualify this new "how to do it" book to serve as a basic course of instruction for apprentices and others interested in aircraft sheet metal work.

The initial chapter of "Aircraft Sheet Metal Work" deals with safety rules. This is followed by information on the use of personal and shop-furnished tools. The next subject, blueprint reading, is treated quite thoroughly and explained in a manner entirely independent of mechanical drawing and related subjects that are not required of sheet metal workers.

The chapters progress from simple to more complicated processes and operations. The emphasis is placed on how to rivet, how to weld, how to use a drop hammer, how to figure bend allowances, etc. Readers of this magazine will be, of course, most interested in chapter 9, which describes soldering, brazing and welding as they are applied to the construction of aircraft. A part of this chapter is devoted to a beginner's oxy-acetylene welding course that includes some 16 projects.

» «

Structural

PRACTICAL DESIGN OF WELDED STEEL STRUCTURES. *By H. M. Priest. Published by American Welding Society, New York City, 1943. Cloth, 5 x 8 in., 153 pages. Price $1.*

This is a bound reprint of an article published in the September, 1943, issue of *The Welding Journal*. The author discusses the various welding processes, specifications for electrodes, types of welds, welding positions, qualification tests and inspection. The subjects of weld geometry and stress concentration are treated at some length, while the physical and metallurgical effects of temperature have also received attention.

Another section deals with codes of the American Welding Society. Unit stresses from these codes (widely adopted for the designing of welded construction) form the basis for the numerous charts and tables which are given to facilitate the design of welded joints and structural members. These charts are so arranged as to be applicable at any specified unit working stress.

Appended to the book is a short bibliography of literature relating to welded construction. This should be of assistance to those desirous of delving deeper into the subject.

» «

Metals

METALS AND ALLOYS DATA BOOK. *By Samuel L. Hoyt. Published by Reinhold Publishing Co., New York City, 1943. Cloth, 7 x 10¼ in., 334 pages. Price $4.75.*

In his latest volume, Dr. Hoyt has compiled a valuable collection of up-to-date and authoritative data on all industrial metals and alloys. The information is conveniently presented in a series of 340 tables giving the latest data pertaining to such properties as tensile strength, hardness, thermal expansion, creep strength, high temperature strength, work hardness, yield strength, hardenability, corrosion resistance, impact values, etc. Because of the comprehensive arrangement of its material, this book should be of great service.

The book is divided into chapters on wrought steels, cast steels, stainless steels, cast irons and non-ferrous metals. Especially complete is the section on the new National Emergency Steels. The chapters on cast steels and stainless steels also contain much helpful information.

Data on hardenability and "S" curves are presented in a way to make them readily understandable by one without a comprehensive knowledge of the subject. The chapters on non-ferrous alloys include the latest available data on aluminum, magnesium, copper, nickel, tin, lead-based and zinc-based alloys.

The voluminous material is arranged for speedy reference and is indexed alphabetically as well as by the main subjects. Hence information regarding any physical or chemical property of a specified metal or alloy may be found quickly. Each chapter contains cross-references to Government, industrial and engineering society specifications, while a section giving the useful industrial properties of all metals in the periodic system is also included.

» «

Drawing

ENGINEERING DRAFTING PROBLEMS. *By K. E. Quier. Published by Harper & Bros., New York City, 1944. Paper, loose-leaf, 8½ x 11 in., 96 pages. Price $2.50.*

This text on engineering drawing is primarily a work book. Its initial 16 pages of introductory notes and instructions are followed by 80 loose-leaf pages of carefully executed plates. The problems in engineering drawing have been designed to prepare the student directly for drafting positions in industry. To the maximum degree possible, he is encouraged to use his own ingenuity and resourcefulness in working out the various possible solutions.

The problems presented will give students the elements of engineering drawing as well as professional drafting experience in the specific fields of mechanical, civil, chemical and electrical engineering. Several plates are devoted to drawings as pertaining to welding and serve to acquaint the student with the use of welding symbols.

Recent developments of the American Standards Association have been followed in this book. The problems selected not only illustrate basic principles but also have practical industrial applications.

» «

Diesel

DIESEL LOCOMOTIVES — MECHANICAL EQUIPMENT. *By John Draney. Published by American Technical Society, Chicago, 1943. Cloth, 5¾ x 8½ in., 472 pages. Price $4.*

Assisted by several authorities in the field of Diesel locomotive manufacturing, Mr. Draney has prepared a volume that should be of special interest to everyone concerned with the servicing, maintenance and operation of modern Diesel locomotives. While particular emphasis is laid on the adaptation of the Diesel engine to railroad transportation, general developments in this field are also discussed in considerable detail.

A major portion of the book is devoted to specific information regarding the particular Diesel engines which are produced by leading manufacturers for railroad applications. Other material includes operating information and maintenance instructions.

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a new specialized WELDING ELECTRODE

FOR WELDING HIGH CARBON and HIGH MANGANESE STEELS

Now you can have a *better* welding electrode . . . one that *lasts longer* and is *easier to apply* . . . for building up or otherwise welding high carbon and/or high manganese steels!

McKAY E-973 is specially made for the job. The weld metal will not cross check or crack under the deposit. Although soft in the "as welded" state, it work hardens rapidly . . . permitting heavy pads to be built up without danger of mushing down, cracking loose, spalling or flaking when subjected to constant wear and service. Exceptionally smooth flowing properties make it unusually easy to apply. It does not require pre-heating or frequent delay for peening.

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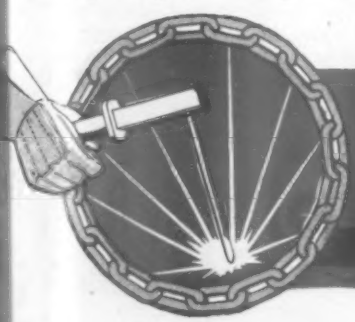

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PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

for FAST, EASY CONTROL

Specify TITAN BRONZE WELDING RODS

★ Titan bronze welding alloys are doubly deoxidized to remove occluded and dissolved gases picked up in the melting. This process prevents the absorption of gases from the torch, from the atmosphere, and from the job itself.

Titan's carefully controlled double deoxidizing process also increases the ductility of the weld, produces a sound dense deposit, and reduces fuming to a minimum.

Mobile, yet easily controlled under the welders torch, Titan welding rods penetrate seams and crevices readily. They are free flowing at 1625° Fahrenheit.

Welders knowing the importance of "uniformity" demand it and are certain of getting it when they use Titan Bronze Welding Rods.

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NEW YORK • CHICAGO • SAN FRANCISCO

Quality Alloys By Brass Specialists

Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

Do You Agree?

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Electrode Comparison Data

Q—Some time ago I saw a chart which compared various arc-welding electrodes by trade names and also gave their AWS classification numbers. Who prepared this chart?—*L. M. H.*

A—You are undoubtedly referring to Engineering Data Sheet No. 30, which was published in THE WELDING ENGINEER, March, 1943. Additional copies of this Data Sheet may be obtained for 10c each.

» «

Arc Welding Heat

Q—How is the heat of arc welding distributed between the electrode and the base metal? I have heard some people contend that straight polarity is the hottest while others say the reverse. What do you say?—*R. V. M.*

A—The distribution of heat, that is in d—c welding, depends upon whether the electrode is the positive or negative side of the work. If the work is positive, welding is being done by straight polarity, and the greater portion of the heat will be concentrated in the base metal. It is estimated that 65 to 75% of the heat of the arc is liberated from the positive side. In a-c welding, the distribution of heat is about 50-50 inasmuch as the current is rapidly reversing its direction with every frequency cycle.

» «

Torch Mixing Device

Q—What is meant when it is said that a welding torch is no better than its mixing device? What is the purpose of a mixing device?—*R. P. R.*

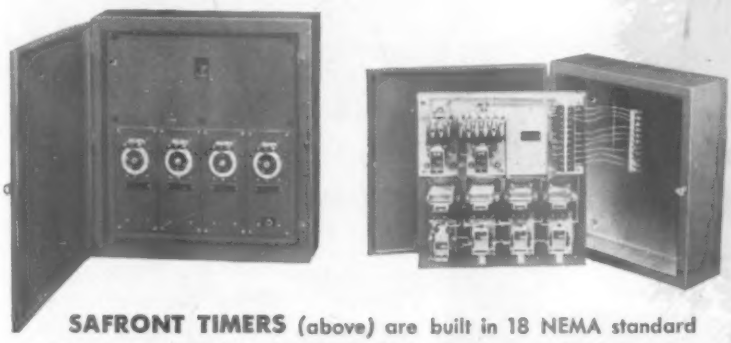
A—The answer to the first part of this question is covered by the answer to the second part. The object of a properly designed mixing device is not only to permit the two gases entering the torch to flow together but to have them do so properly.

The primary purpose of a mixing device is to bring the fuel gas and the oxygen together. This must be accomplished in such a manner that the proper gas ratio and proper velocities are maintained. The design of the mixing device must also be such as to eliminate insofar as practicable the possibilities of backfire, flashback or "popping." The two gases should be mixed in such a manner as to maintain the proper flame and shape. Likewise, they must be mixed so as to give an exit velocity to the mixed gas that does not create a blowy flame.

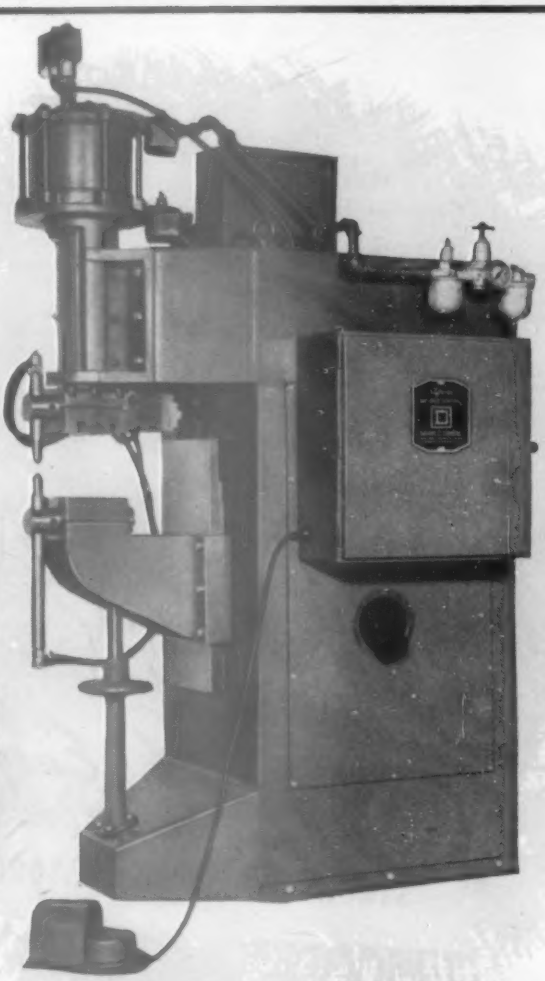
MORE PRODUCTION WITH LESS OPERATOR SKILL *when resistance welders have* SQUARE D *Automatic* CONTROL

● Consistently good resistance welding at high production rates requires automatic control of pressure and current in an accurately regulated sequence. Square D welder control meets those requirements—exactly. It is simply designed, easy to install and maintain. With Square D automatic control on the job, very little operator skill is required—a vital angle during today's scarcity of skilled manpower.

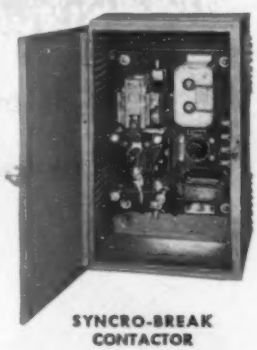
Specify Safront timers and Syncro-Break or High Speed contactors on new welding machines. Or, if increased quality and production is needed from present machines, find out how easily they can be equipped with automatic control. Consult your nearest Square D Field Engineer.



SAFRONT TIMERS (above) are built in 18 NEMA standard types. Notice, in upper left photo, how all electrically energized parts are behind a protective panel, yet calibrated timer adjustments are accessible on panel front. Separate timing devices, provided for each step of the welding cycle, are individually adjustable from 3 to 100 cycles. Safront interiors "swing out" (upper right photo) to expose operating parts.



HIGH SPEED CONTACTOR



SYNCRO-BREAK CONTACTOR

HIGH SPEED AND SYNCRO-BREAK CONTACTORS (right) possess unusual design features necessary for frequent making and breaking of the welding transformer primary circuit. The Syncro-Break design includes means for opening circuit without arcing at contact tips, thus increasing contact life and allowable ratings.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Tool Repair Booklet

"How to Repair Broken Cutting Tools with Easy-Flo" is a 16-page, letterhead-size publication that should fill a long-felt need throughout the welding industry for a comprehensive instruction booklet on tool repair by the widely used silver-brazing process. The new Bulletin No. 14 begins with a discussion of the properties of "Easy-Flo," a low-temperature silver brazing alloy that is fluid at 1,175 F. General instructions are then given with regard to the four basic steps of: (1) cleaning, (2) fluxing, (3) preplacing the alloy and (4) applying the heat by: (*a*) torch (*b*) furnace (*c*) dip in a hot salt mixture or (*d*) induction heating.

The last half of the booklet is devoted largely to the repair of specific tools. Pictures are scattered profusely throughout the text to illustrate the proper methods of repairing band saws, drill and taps, broaches, milling cutters, form cutters, forming tools, and slitting saws. The mounting of high-speed-steel tips and cemented-tungsten-carbide tips on mild steel shanks is also covered. **Handy & Harman,** 82 Fulton St., New York City 7.

» «

"More about Victor"

This 40-page, letterhead-size pictorial booklet was published to acquaint stockholders, customers and co-workers with the detailed operations of the **Victor Equipment Co.,** 844-54 Folsom St., San Francisco 7. Besides picturing the company's facilities and products, it reproduces many interesting photographs of gas-welding and flame-cutting operations in aircraft plants, shipyards, underwater cutting, bridge building, fabrication of invasion craft, etc.

» «

Tool Steel Welding Manual

"Arc Welding in the Maintenance and Construction of Tools and Dies" is a 20-page, letterhead-size handbook of engineering data, welding procedures and heat treatments for tool and die steels. This booklet gives detailed descriptions of ten types of electrodes, photomicrographs showing grain structures, tempering curves, hardness and temperature conversion tables, etc. Heat-treatment data, deposit characteristics, physical properties and special details of application procedure are furnished for each electrode. The successful use of arc welding for dies and tool steels, it is emphasized, depends on the securing of a deposit possessing physical properties comparable to those of the parent metal and qualities which respond to the same heat treatment. **C. E. Phillips and Co.,** 2750 Poplar St., Detroit 8.

» «

Flame-Hardening Booklet

"Ordnance Flame-Hardening" is the title of a 12-page booklet describing the application of the flame-hardening process to tank bogie wheel rims, tank turret rings, tank driving sprockets, tank tread grousers, gun mount gear teeth and other articles of warfare. The text is a reprint of an AWS convention paper recently published in *The Welding Journal.* The author describes both manual and machine methods, progressive hardening, simultaneous hardening and tempering, etc., and gives factual data on the equipment employed and results achieved. **Air Reduction Sales Co.,** 60 East 42nd St., New York City 17.

» «

Electronic Control Data

A four-page, letterhead-size folder, GEA-4207, furnishes technical information on the new G-E current-regulating compensator for thyratron welding control. Several typical applications in war industry are given to illustrate the advantages of using this type of electronic control for spot and seam welding. **General Electric Co.,** Schenectady.

FACTS for WELDERS . . . Here's the most practical, up-to-date data on selecting and using welding rods for best results. Write for your copy.

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Results can only be as good as the welding rod you use. Bridgeport's metallurgical research and development...knowledge of and long experience in meeting welding requirements...makes Bridgeport Bronze Welding Rods truly...

"EQUAL TO ANY JOB...WORTHY OF YOUR SKILL"

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"Bridgeport" **BRASS**

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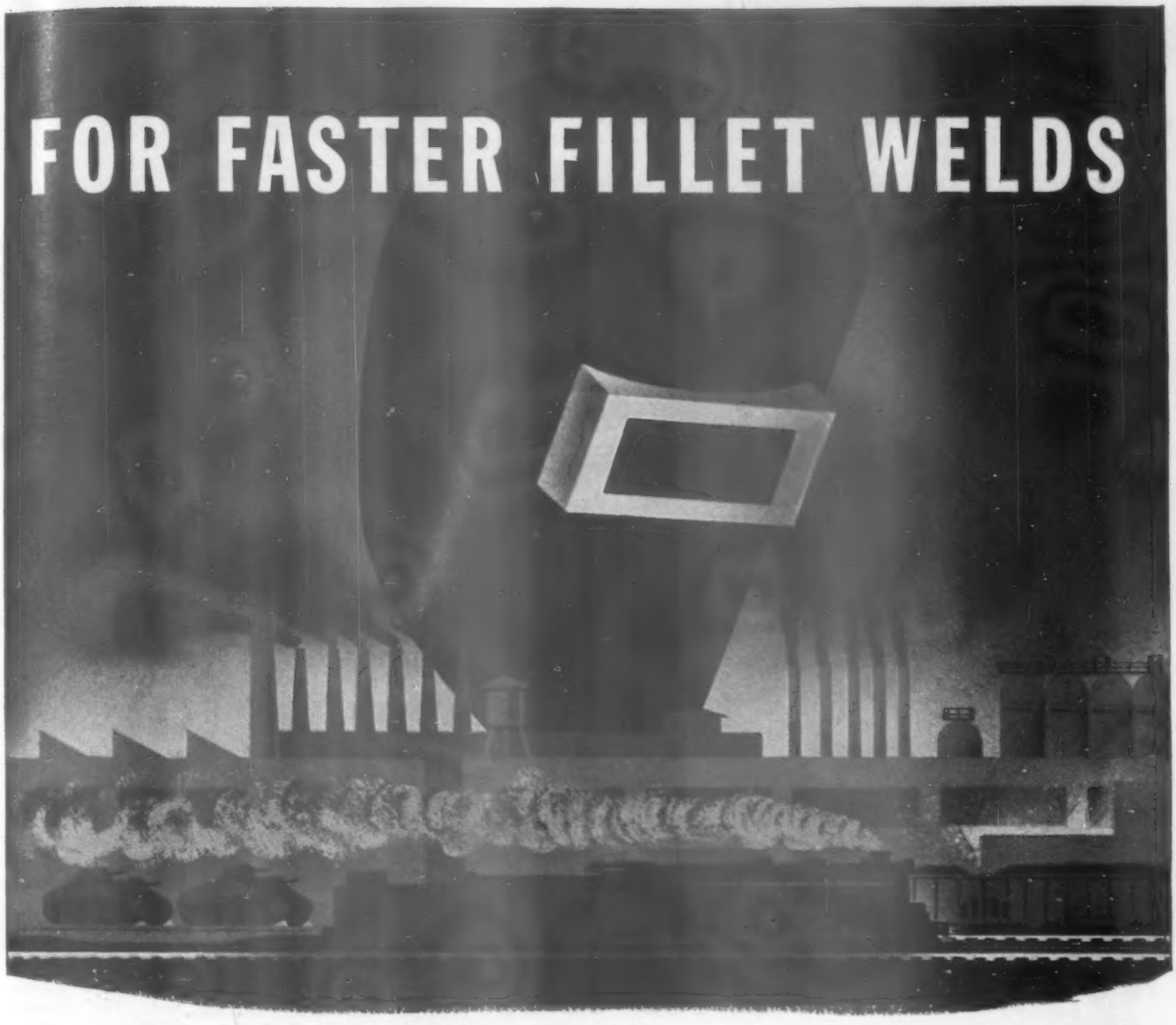

Use Raco 20 Shielded-Arc Electrodes

High-quality deep penetration single-pass fillet welds, and more of them per hour, are assured when you use Raco 20 Shielded-Arc Electrodes. And with these electrodes you can obtain the same top-grade production whether you employ direct current straight polarity or reverse, or alternating current.

The advantages of Raco 20 Shielded Electrodes are of greater importance now than ever before. We shall be glad to send you samples so you may test their outstanding performance. Just write

Raco 20 Conforms with the following specifications: A.W.S.—A.S.T.M. Specification A233-42T, Type E-6020. U. S. Bureau of Ships Specification 46E3 (INT) Grade II Class 2.

The **REID-AVERY COMPANY**

DUNDALK BALTIMORE 22 MARYLAND

Sciaky Bulletin

A four-page letterhead-size bulletin has been published to discuss various possible applications of the new Sciaky "locating spotlight." This is a device to position work accurately by directing a spot of light on the stationary member of the machine. In the case of spot welding, two lights are used to gauge spacing: one directed to the lower electrode and the second fixed at a predetermined distance from the first spot. The locating spotlight may also be used on automatic riveting machines, dimpling and countersinking machines, clinching and stitching machines, punch and drill presses, shearing and forming presses, etc. **Sciaky Brothers,** 4915 W. 67th St., Chicago 38.

Flexible-Shaft Catalog

Stow Catalog No. 40 A is a 28-page, letterhead-size booklet devoted to descriptions, technical information and pictures of flexible-shaft machines for grinding, sanding, wire brushing, drilling, buffing, polishing and filing. **Stow Manufacturing Co.,** Binghamton, N. Y.

» «

File for Product Designers

Sweet's "File for Product Designers," compiled for the first time this year, is a letterhead-size file of 200 manufacturers' catalogs containing 1,500 pages of specific product information on materials, finishes, parts, techniques and work equipment. This file is offered free to qualified organizations, and inquiry is invited from manufacturers or individuals who would be interested in obtaining it. **Sweet's Catalog Service,** division of F. W. **Dodge Corp.,** 119 West 40th St., New York City.

» «

Manganese Steel Bulletin

"Manganese Steel for the Clay Products Industry" is another in the series of informative booklets devoted to the uses of manganese steel in the nation's basic industries. Bulletin No. 1243-CP has 32 letterhead-size pages to cover excavating, hauling, crushing, mixing and manufacturing equipment. A short section discusses the reclamation of wearing surfaces by hard-facing. **American Manganese Steel Div., American Brake Shoe Co.,** Chicago Heights, Ill.

» «

Grinder Catalog

The 20-page, letterhead-size "DoAll" grinder catalog shows the complete line of surface-grinding equipment manufactured by the **Savage Tool Co.,** Savage, Minnesota, as well as accessories such as grinding wheels, electromagnetic chucks, wet or dry grinding attachments, etc. A brief description of "DoAll" precision gauge blocks and gauge instruments is also included.

» «

Bending Press Catalog

A new eight-page, letterhead-size catalog, No. 2010-A, has been issued to picture and describe the several members in the line of Cleveland "Steelweld" bending presses. Handling plate up to 1 in. thick and lengths up to 20 feet, these versatile tools can be arranged to do bending, forming, blanking, drawing, multiple punching, etc. **The Cleveland Crane & Engineering Co.,** Wickliffe, O.

» «

Skin Cream Folder

"Common Sense vs Dermatitis" is the title of a four-page, 3½ by 5½ in. leaflet describing a line of four products for preventing and treating skin troubles. These are: "Neo-Film," a protective liquid applied before work; "Skin Kreme" for workers suffering from dry skin; "Zomine," a mild healing ointment, and "Zolamide," which contains two sulfa-drugs in a special absorption base and is used for infectious-type skin ailments. **Jones Medical Laboratories,** Inc., 800 Huron Road, Cleveland 15.

» «

Spot-Welder Catalog

Manual and automatic spot welders made by **Pier Equipment Mfg. Co.,** Milton and Cross Sts., Benton Harbor, Mich., are illustrated and described in the company's new 12-page, letterhead-size Catalog No. 42. The foot-operated welders listed range from 5 to 50 kva capacity; the air-operated press types include 20 to 30 kva capacities, and the high-speed projection and spot welders range from 30 to 150 kva capacities.

IT'S *Quicker* TO USE A

CMD *Triple-Duty* CHIPPING HAMMER

With the Type CB combination drift and chisel hammer, a welder can greatly speed up his output. For he can spend more time welding and less time removing slag—less time laying down tools and picking them up. Without even setting aside the electrode, he can start immediately to chip away the slag. The handy replaceable brush on the handle of this hammer is instantly available when he needs it. For details and prices on this and other popular CMD welders' Chipping Hammers, ask your jobber for latest circular or write direct.

Triple Duty TYPE CB
3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

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1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

Another Battle Front Oxygen Producing Plant

ANOTHER, another in the steady stream of Independent Mobile Oxygen Generators is on its way to our fighting forces... *somewhere* on the world Battle Fronts... supplying oxygen to our "*hi-flying*" air squadrons who could not leave the ground without their oxygen tanks filled. • • Independent... *first* to produce these Mobile Oxygen Generators—First Too in actual service—You'll find Independent Engineering Company *first*—after Victory—to supply *you* with equipment for producing industrial gases for peace-time pursuits.

Independent Engineering Co.—Pioneer designers and producers of Mobile Oxygen and Hydrogen generating plants for the armed forces... builders of Oxygen, Hydrogen and Acetylene plants —manufacturers of industrial gas cylinders and cylinder handling equipment.

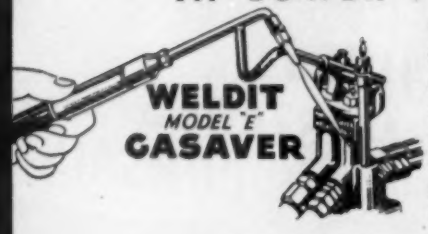
ARMY E NAVY

INDEPENDENT ENGINEERING CO.

O'FALLON INCORPORATED ILLINOIS

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

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Diamond-Wheel Questions

To answer users' and prospective users' questions concerning diamond-impregnated metal-bonded grinding wheels, **Larco Diamond Tools,** 551 Fifth Ave., New York City 17, has published a 32-page, letterhead-size "question and answer" bulletin. The questions are those actually received regarding these wheels, and authoritative answers have been furnished by the company's experts. The booklet covers recommended uses, restrictions, economical operation and proper maintenance of this newly developed equipment for grinding and polishing tungsten carbide tools.

» «

Air Compressor Catalog

Schramm Catalog No. 4215 contains ten letterhead-size pages describing in detail the company's No. 60 type of compressor and its various mountings for service in the construction and engineering fields, railroads and small industrial installations. **Schramm, Inc.,** West Chester, Pa.

» «

Connector Catalog

A 68-page, letterhead-size catalog, Technical Bulletin 6050, describes the various sizes and styles of "Hydent" electrical connectors of the indent type. These connectors have a variety of applications in the marine, aircraft, electronic and electrical manufacturing industries. **Burndy Engineering Co., Inc.,** 107 Eastern Blvd., New York City 54.

» «

Powder Metallurgy Book

A 32-page booklet, "Powder Metallurgy," covers the advantages and latest applications of powdered metal parts. Of particular interest to companies investigating the possibilities of this method are the "Designers' Aid Section" and the "Table on Engineering Properties." Types of design and specifications for both standard forms and intricate shapes are presented in detail. **Keystone Carbon Co., Inc.,** Saint Marys, Pa.

» «

Furnace Data

What the heat treating furnace has done for the war effort and what it will be called upon to do in the postwar world of tomorrow are the themes discussed in "The Heat Treating Furnace," a 32-page, 5¼ by 6¾ in. booklet which outlines the factors—tangible and intangible—that go to produce a good industrial furnace. **Surface Combustion,** Toledo, O.

» «

Fire Extinguisher Data

A pocket-size booklet, "Recharging Instructions for Carbon Dioxide Extinguishers," has been published by the **C-O-Two Fire Equipment Co.,** Newark 1. Detail drawings help to make clear the by trade names and also gave their AWS procedure to be followed for both system cylinders and portable extinguishers.

WHEN YOU CHECK UP ON YOUR PLANT'S PAY-ROLL SAVINGS PLAN FIGURES!

These days, things change with astonishing speed. The Pay-Roll Savings Plan set-up that appeared to be an outstanding job a short time ago, may be less than satisfactory today.

How about checking up on the situation in *your* plant? Checking up to see if everybody is playing his, or her, part to the full measure of his, or her, ability. Checking up to see if 'multiple-salary-families' are setting correspondingly multiple-savings records.

A number of other groups may need attention. For example, workers who have come in since your plant's last concerted bond effort. Or, those who have been advanced in position and pay, but who may not have advanced their bond buying accordingly. Or even those few who have never taken part in the plan at all. A little planned selling may step contributions up materially.

But your job isn't finished, even when you've jacked participation in your Pay-Roll Savings Plan up to the very top. You've still got a job before you—and a big one! It's the task of educating your workers to the necessity of not only buying bonds, but of *holding* them. Of teaching your people that a bond sold before full maturity is a bond robbed of its chance to return its full value to its owner—or to his country!

So won't you start *checking* . . . and *teaching* . . . today?

War Bonds To Have And To Hold!

LET'S ALL BACK THE ATTACK WITH WAR BONDS!

The Treasury Department acknowledges with appreciation the publication of this message by

THE WELDING ENGINEER

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

News of the Industry

Women Workers Increase in Shipyards, Aircraft Plants

Evidence of women's spectacular contributions to the war program in industries that traditionally employ men only is submitted in a lengthy report prepared by the Office of War Information. Including clerical workers, women now hold one job out of every eight in American shipyards and 35.8% of all jobs in aircraft plants.

"In March, 1939, the Census of Manufacturers listed only 36 women wage earners in shipbuilding," the OWI report states. "In March, 1942, less than 1% of the wage earners in shipyards were women. On Jan. 15, 1944, according to the Bureau of Labor Statistics, the number had increased phenomenally to 10%.

"The number of women employed in aircraft assembly increased nine times in the first year of the war. By April, 1942, 6% of the productive workers in aircraft assembly were women. In January, 1944, female wage earners in airplane engine and propeller plants numbered over 473,000."

Hard-Facing gives Ball Mill Scoop Lips More "ON THE BALL"

WHEN YOU REALIZE that Coast Metals patented alloys possess extraordinary wear-resistance, you naturally expect these hard-faced scoop lips to successfully withstand hard use and abuse and to last longer. And that is just exactly what has happened!

Because of their Coast Metals protective overlay, welded over surfaces exposed to severest wear, they are giving more and better service than ever before. When they become worn, another Coast Metals Hard-Facing makes them as wear-resistant as when new.

Successful applications such as this indicate the possibilities for making your own equipment last longer at surprisingly low cost. Coast Metals Hard-Facing is easily, quickly applied.

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COAST METALS hard-facing weld rods

MAKE YOUR EQUIPMENT LAST LONGER

Marinship Sets Record—Four Tankers per Month

Marinship Corp., Sausalito, Calif., achieved one of its greatest ambitions when four complete 10,000 hp turbo-electric tankers were delivered during March. The ships were the *Mission Santa Ynez, Mission San Rafael, Mission Solano* and *Mission San Luis Rey*—part of a series of tankers named for early California missions which are being built by Marinship for the Maritime Commission.

» «

Women Help to Make Tubing at Tubular Alloy Steel Corp.

Representatives from the armed forces, Government, business and the industrial press who assembled in Gary the morning of April 5 for an inspection trip were impressed by the large number of women workers who are taking men's places in the newly converted plant of the Tubular Alloy Steel Corp. To be exact, 48% of the plant's 3,700 odd employees are women, who serve as crane operators, testers, draw bench and machine operators, tractor operators, truck drivers, etc.

Tubular Alloy Steel Corp. occupies 37 acres of industrial buildings in Gary. The main building has a floor area of 36 acres and houses the hot mills, billet yard, machine and blacksmith shops, cold processing and finishing departments, stockroom and a large shipping bay. The company's war products include tubing for Army and Navy aircraft, for tank pins, tank pin bushings and other tank parts and tubing for other heavy-duty requirements such as bearings for airplane, truck and tank engines.

» «

ASA Approves Standards for Protective Clothing

American Standards Association has approved the first three of a series of war standards for Protective Occupational Clothing. The new standards are: American War Standard for Leather Aprons (L18.1-1944), American War Standard for Leather Cape Sleeves (L18.2-1944) and American War Standard for Leather Leggings (L18.3-1944).

These standards provide specifications for the different kinds of leather aprons, cape sleeves and leggings which ASA considers necessary to adequately protect men and women engaged in industrial occupations against sparks, molten metal, infra-red and ultra-violet rays. They are printed in one pamphlet, which may be obtained for 30 cents a copy from the American Standards Association, 29 West 39th St., New York City 18.

» «

A. O. Smith Appoints California Distributor

A. O. Smith Corp., Milwaukee, announces the appointment of Pacific Metals Co., Ltd., as distributor in California, Nevada and Arizona for "Smithway" electrodes, a-c welders and other equipment. Pacific Metals will carry these products in its warehouses at 3100 Nineteenth St., San Francisco, and at 1400 South Alameda St., Los Angeles.

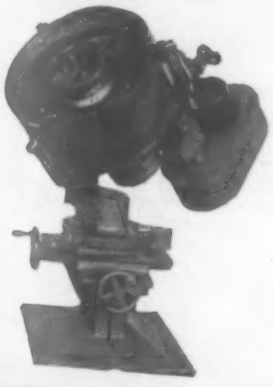
Save Time While Reloading!

Automatic Welding-head Positioner — adaptable to your own holding fixture.

WRITE for information relating to your particular welding fixture problem

How TO SPEED UP WELDING OPERATIONS!

Use This Dual Automatic Welding Fixture!



THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

ACME Manufacturing Co.
1642 HOWARD ST. • DETROIT, MICH.

YOU CANNOT HAVE A BETTER FRIEND THAN LEATHER . . . particularly the way LICHTMAN produces fine, chrome-tanned cowhide for the welder

LICHTMAN J.L.&S. LEATHERS TRADE MARK

Manufacturers of protective clothing confirm the statement

J. LICHTMAN & SONS
NEWARK 5, N. J.

Tanners of Quality Leathers Since 1883

New AWS Section Formed in Portland

Latest section of the American Welding Society is the newly organized Portland section, Portland, Ore. Officers of this group, elected at an organization meeting on April 13th, are:

Elmer Hann, general superintendent, Kaiser Company, Swan Island, chairman; Frank Ofner, superintendent of finishing, Electric Steel Foundry, vice-chairman; Paul Kulberg, manager, Industrial Specialties Company, secretary; Bud Westover, welding superintendent, Monarch Forge & Machine Works, treasurer.

The Portland section has approximately 100 members and four sustaining members. These are: J. E. Haseltine & Co., represented by Paul W. Chatterton; Monarch Forge & Machine Works, represented by M. D. Westover; Electric Steel Foundry, represented by Frank Ofner, and Willamette Iron & Steel Corp., represented by Arthur O. Brown.

» «

Jigs, Unskilled Labor Together Spell Victory

Jigs and fixtures have made possible the wide-scale employment of unskilled labor and have thus speeded up the production of war equipment, Master Mechanic Milton C. Taylor of the Bastian-Blessing Co., Chicago, told the jig and fixture design panel of the "Share an Idea for Victory" Conference. The conference (see page 47) was held under the auspices of the Chicago Technical Societies Council in coöperation with the Army, Navy and War Production Board.

Taylor addressed the panel on "Eliminating Operations by Fixture Design." In connection with his talk, he showed colored pictures of some of the new fixtures designed by himself and other engineers of his company, a leading manufacturer of gas welding and cutting equipment.

» «

Manganal on the Air on Pacific Network

Chet Huntley, ace newscaster, is being sponsored by Stultz-Sickles Co. in a 5-minute weekly program, "Manganal on the Air," given over the basic Pacific Network of the Columbia Broadcasting System. This program appears at 8:55 every Thursday night over stations in Los Angeles, San Francisco, Stockton, Fresno, Sacramento, Portland, Seattle and Spokane. An introductory package of Manganal and Seaco electrodes is offered to listeners who can use them in their work.

Victor Equipment Co., San Francisco, is mentioned in the broadcast as the local distributor of these welding products.

» «

Claudette Colbert Becomes Weldorette

In her latest picture, "Since You Went Away," Claudette Colbert joins the ranks of the thousands of women who are welding in shipyard and aircraft plants. Claudette doesn't get along so well in the picture, but actually she learned to weld very quickly, according to G. L. Revell, welding engineer for the Lincoln Electric Co.

Revell, who is Claudette's welding instructor in the movie, was originally brought to the studio to help arrange the set for the welding school and give technical pointers. His "instructing" so impressed Producer David O. Selznick that he asked Revell to play the part that had originally been scheduled for a professional actor.

Precision Ground Glass Gages Afford Visibility in Inspection

In the hands of the skilled mechanic, glass gages bring an important plus function to precision gages. It not only checks the new tool's size, but gives the inspector an idea of what kind of surface to expect from that particular tool. The visibility permitted by the glass gage allows the inspector to see the surface in blind holes as well as through holes.

Some of the apparent advantages of the glass gage follow: Glass gages afford visibility in inspection. Glass gages are not subject to corrosion. There is less tendency to gall in some applications. Sense of feel is more pronounced when using glass gages. Because the thermal conductivity of glass is less than steel, body heat of inspectors will not be transmitted so rapidly to the gage to affect gaging dimensions.

Chewing gum, too, is really useful and helpful in these tense times to people who are working on the production front making material for our war effort. But, our Armed Forces have been constantly increasing their demands for Wrigley's Spearmint, Doublemint and Juicy Fruit. It is only natural that we and you both feel that the needs of our fighting men and women come first.

You can get complete information from Industrial Glassware Division of the T. C. Wheaton Co., Millville, N. J.

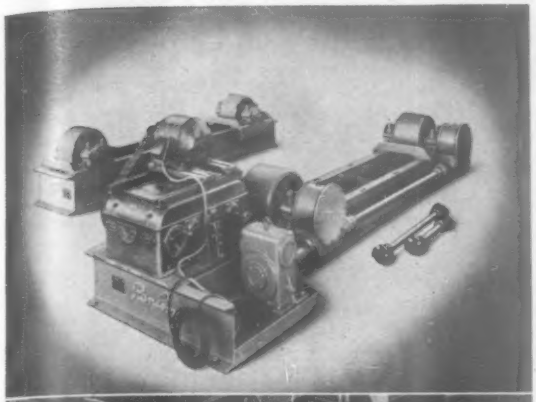
Glass gages are not subject to corrosion or rust

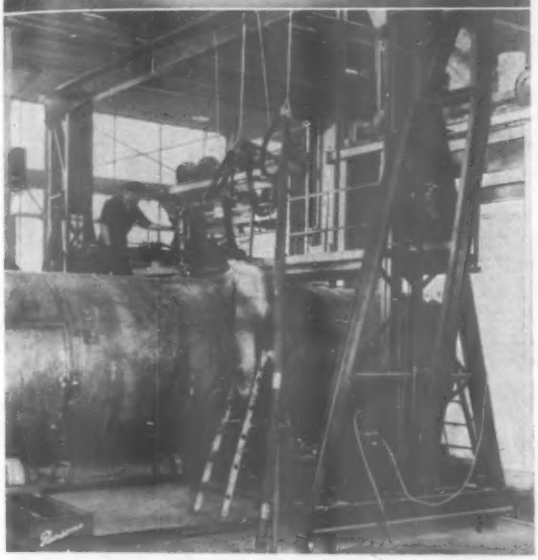
Visual inspection of surface coincident with inspection for size.

Y-113

Courtesy, American Manganese Steel Div.

"Pete wears two masks an' a backstop since one o' th' babes flipped a hot welding-rod inside his overalls!"





TURNING ROLLS *and* AUTOMATIC WELDING

The Perfect Team... FOR BETTER AND FASTER TANK WELDING

The constant uniform speed of Ransome Turning Rolls makes them ideal for use with automatic welding heads when welding large circular tanks and cylinders.

The units are equipped with variable speed transmissions giving a wide speed range and means for changing the center-to-center distance of the rollers for handling work of various diameters. Smoother, better welds and more economical production result. · Write for full information.

WELDING POSITIONERS · HEADSTOCKS-TAILSTOCKS · SPECIAL POSITIONING EQUIPMENT

Ransome
MACHINERY COMPANY
DUNELLEN, NEW JERSEY
SUBSIDIARY OF WORTHINGTON PUMP AND MACHINERY CORPORATION

Count 'em

THREE!

❶ Purer, hotter acetylene gas at savings up to 75%.

❷ Assured source of supply—no delivery delays from bottlers.

❸ No large-job interruptions — thanks to Sight Feed's "visible" carbide supply.

These three advantages are YOURS with Sight Feed. Order today!

THE *Sight Feed* GENERATOR COMPANY • SALES: RICHMOND, INDIANA • FACTORY: W. ALEXANDRIA, OHIO

for more SAFETY in your plant..

GOGGLES
GAS MASKS
HELMETS
RESPIRATORS ✓
SAFETY SERVICE ✓

In making safety equipment, with human life at stake, Willson will neither skimp nor compromise. Here's one of many ways Willson makes sure its products are really safe:

THE MAN WITH THE ONE-WAY NOSE

Oscar here is on the Willson research staff for one unusual reason: He can inhale without exhaling. Put a respirator on him and he'll inhale tainted air as long as his colleagues wish, while they record the respirator's performance.

The respirator shown here, #780, is only one of more than 50 styles we make to meet every known industrial need. #780, for instance, is Bureau of Mines-approved for protection against metal fumes, toxic dusts, chromic acid mist. If you have a problem in lung, head or eye protection, our 74 years' experience is at your service.

There's a Willson Safety Service Distributor in every major industrial area.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON
PRODUCTS INCORPORATED
READING, PA., U. S. A. Established 1870

All-Welded Box Cars Coming after the War

Welding will be used extensively after the war to build lightweight box cars that will save up to 20% in weight, Wallace N. Barker, vice-president of Pullman-Standard Car Mfg. Co., predicted in connection with the publication of a recent special welding issue of the company's magazine, *The Carbuilder*.

"In the welding which we will do in the postwar period we will make use of our experience in manufacturing war products for the Army and Navy," said Vice-President Barker. "These products take far more abuse on the battlefield and in naval combat than railway cars ever do in normal operation, yet they have demonstrated that they can take it."

» «

Airco Moves Chicago Office

The Air Reduction Sales Co. has moved its Chicago sales and engineering office to 332 So. Michigan Blvd. The other offices of the Airco Chicago branch will continue to function from 3100 So. Homan Ave., the address of the district office prior to this move.

» «

AWS Cleveland Section Holds Annual Conference on May 12

The Cleveland Section of the American Welding Society will hold its annual conference at the Hotel Statler, Cleveland, on May 12. The program will include an afternoon session, a dinner and an evening session. Speakers scheduled to appear are: W. Conley, Lincoln Electric Co.; Jack Spence, Stoody Co.; A. G. Bissel, Bureau of Ships; David Arnott, president, American Welding Society, and B. F. Stout, Stout Laboratories.

» «

Albert Ramond & Associates Replaces Bedaux Co., Inc.

The engineering firm of Albert Ramond and Associates, Inc., has succeeded the Bedaux Co., Inc. Under its new name, the firm will be managed by the same group of executives who have directed it since 1937. These include: Albert Ramond, president; J. C. Cramer, chief engineer; A. A. Dobson, C. T. Dunn, C. W. English, W. M. Fanning, M. E. Fuller, J. C. Heiberger and J. W. Roberts, vice-presidents.

» «

Philadelphia Distributor

Welding Equipment & Supply Co., Detroit 7, has appointed the Arcway Equipment Co., 3717 Filbert St., Philadelphia, as distributor for Eureka tool steel and alloy welding electrodes.

» «

Chicago Distributor

Chicago Welding Sales Co., 3349 W. Ogden Ave., Chicago, has recently been appointed distributor of Unamatic welding equipment in the Chicago area for Una Welding, Inc., Cleveland.

"GENERAL" WELDING FUME EXHAUSTERS

For effective elimination of the *Noxious Fumes* from

Arc Welding
Galvanized Iron Soldering
Spray Painting, Etc.

TWO TO TEN INLETS—

For multiple hose connections in shop and field operations.

SINGLE INLET UNITS—

For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

SEMI-PORTABLES—

Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

PORTABLE "JUNIORS"—

40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

Bulletin CB-103 gives specifications and dimensions for the 28 types and sizes comprising the "General" line.

GENERAL BLOWER CO.

403 N. Peoria St., MONroe 0244
New York CHICAGO 22, ILL. Detroit
Pittsburgh Philadelphia Cleveland

C-F POSITIONERS

as far as the eye can see . . .

through the light haze of this gigantic welding department extend triple rows of C-F Positioners. From this almost endless production line (the photograph is taken from the half-way point) each day come heretofore unheard of numbers of fabrication with all seams, joints and unions strongly and smoothly welded "downhand".

There are no handling problems or delays, for on C-F Positioners each welder positions his weldment for succeeding welds with a pushbutton control—can rotate it at any desired speed (360°) or tilt it to any angle up to 135° beyond horizontal.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO. **1309 S. Kilbourn Ave.** **Chicago 23, Ill.**

DALLETT

PNEUMATIC WELD-FLUX SCALING HAMMERS

Especially designed for roughing, peening, removing flux and excess metal resulting from welding operations.

- made in several sizes
- button or lever type throttle
- safety chisel retainer
- smooth in operation
- light in weight

write for Bulletin No. 500

THE DALLETT COMPANY

MASCHER AT LIPPINCOTT STREET **PHILADELPHIA 33, PENNSYLVANIA**

Distributed in Canada by G. D. PETERS & CO. OF CANADA, Ltd., 1021 New Birks Bldg., Montreal

PNEUMATIC AND HAND CHISELS ■ "DALBO" AIR HOSE COUPLINGS

"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS

■ ■ *"DALWELD" DETACHABLE WELDING CABLE CONNECTORS* ■ ■

ABOUT PEOPLE

Dr. V. N. Krivobok, until recently chief metallurgist of the Lockheed Aircraft Corp. at Burbank, Calif., has become associated with the development and research division of the International Nickel Co., Inc., New York City. His services will be utilized mainly in the development of markets for alloy and stainless steels and to assist steel manufacturers in expanding markets for their postwar products. A recognized authority on stainless steel, Dr. Krivobok was professor of metallurgy at the Carnegie Institute of Technology prior to his connection with Lockheed.

» «

Walter J. Truettner, formerly secretary of the Marysville plant of the Dow Magnesium Corp., has been selected to head the Detroit office of the Dow Chemical Co. **Ralph B. Ehlers,** assistant chief engineer of Dow Magnesium Corp., will be located at the new Detroit office in charge of magnesium distribution and service.

Frederic V. Hetzel, consulting engineer and writer on technical subjects, has been appointed a member of the American Standards Association's Committee on Transmission Chains and Sprockets. The work of this committee covers the formulation of standards for transmission roller chains and sprocket teeth, also the study of possibilities for standardizing the so-called "silent" type of transmission chains and sprockets.

» «

Dr. William A. Pennington, formerly with the Mellon Institute, Pittsburgh, has been added to the research staff of the engineering division of Carrier Corp., Syracuse, N. Y. He will devote his time to metallurgical and chemical research.

» «

Frederick E. Moskovics, for the past three years technical advisor to the supervisor, Army Air Forces, has accepted the appointment of industrial consultant with the A. O. Smith Corp., Milwaukee. The designer of one of the country's earliest motor cars, the Allen-Kingston, Mr. Moskovics was vice-president of the Nordyke-Marmon Co. for 15 years and later served five years as president of the Stutz Motor Car Co.

» «

Robert Phair was recently named chief electrical and welding engineer of the Edward G. Budd Mfg. Co., Philadelphia. He succeeds **John Fetcher,** who has been appointed head of the methods and equipment department. Mr. Fetcher succeeds **Fred E. Laig,** who has been appointed to the staff of Mr. Budd, Jr., in connection with the production of the company's cargo plane.

» «

Delmar M. DeWolf, who has been assistant advertising manager and editor of the *Skilsaw Blade* for the past three years, has been appointed advertising manager of Skilsaw, Inc., Chicago.

» «

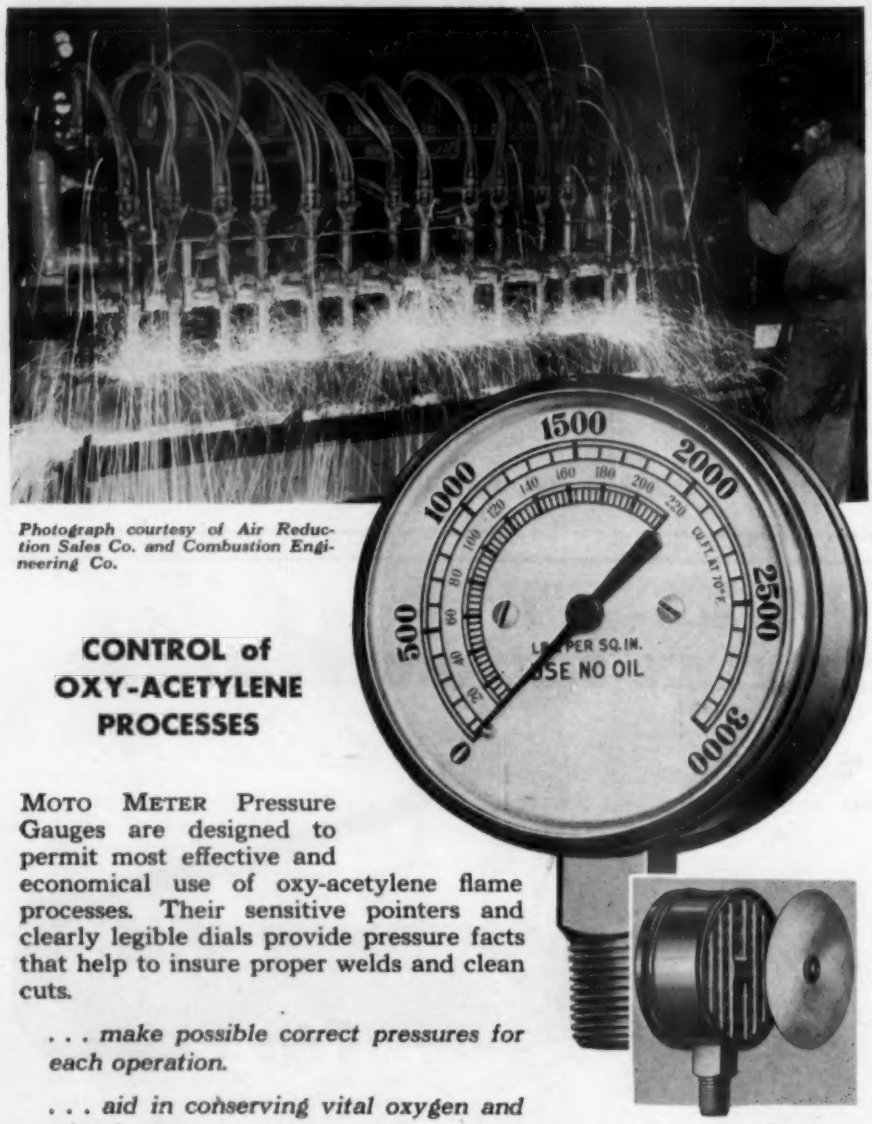
Edward V. Creagh has been appointed advertising and sales promotion manager of American Chain & Cable Co., Inc., Bridgeport, Conn., and associated companies including the Page Steel and Wire Division. He has been in charge of sales promotion activities since 1936. His new duties will cover the supervision of newspaper, magazine, business publication and other forms of advertising.

» «

Mead W. Batchelor, works manager of the mill division of the Bridgeport Brass Co., Bridgeport, Conn., has been named a vice-president. **A. Dean Merwin,** sales manager of the company's fabricating division, takes on the responsibilities of assistant secretary.

» «

John C. Wilson, superintendent of Plant No. 2 of the United Electronics Co., Newark, has been named chairman of the local War Production Drive Committee to succeed Vice-President C. A. Rice.



Photograph courtesy of Air Reduction Sales Co. and Combustion Engineering Co.

CONTROL of OXY-ACETYLENE PROCESSES

MOTO METER Pressure Gauges are designed to permit most effective and economical use of oxy-acetylene flame processes. Their sensitive pointers and clearly legible dials provide pressure facts that help to insure proper welds and clean cuts.

. . . make possible correct pressures for each operation.

. . . aid in conserving vital oxygen and acetylene gases.

Exclusive construction incorporates grid-plate safety feature shown at right. MOTO METER Pressure Gauges are listed as approved by Underwriters Laboratories.

EXTRA PROTECTION

for operator and plant equipment is obtained through grid retainer plate, exclusive with MOTO METER Pressure Gauges.

THE ELECTRIC AUTO-LITE COMPANY

MOTO METER GAUGE & EQUIPMENT DIVISION

CHRYSLER BUILDING, NEW YORK 17, N. Y.

FACTORY LA CROSSE, WISCONSIN

SAVE GAS . . .
SPEED UP PRODUCTION WELDING
with the new
Gasweld "69" ECONOMIZER

● This unique device saves both man hours and welding gas—two important factors in these busy war days. The "Economizer" is a "must" for all production welding operations.

SAVES GAS—Torch burns only when actually welding.

SAVES TIME—Where intermittent welding is done it is unnecessary to relight and readjust torch each time a weld is started.

Hanging the torch on the convenient arm automatically shuts off both gas control valves in the "Economizer" . . . picking up the torch automatically opens the valves . . . a touch to the pilot flame lights the torch instantly, ready for work, without readjustment of the gas mixture.

The convenience of the "Economizer" can be yours at an amazingly low cost. Write for prices and further information.

Torch illustrated is the lightweight Gasweld AV-10 ideal for aluminum and light metals, one of a complete line of Gasweld torches and gas welding equipment.

Buffalo 10, N. Y.
Cincinnati 4, O.
Chicago 23, Ill.
Detroit 8, Mich.
Louisville 2, Ky.
Milwaukee 2, Wis.

WALL CHEMICALS DIVISION of
The Liquid Carbonic Corporation
3110 S. Kedzie Ave., Chicago, Ill.

Rochester 8, N. Y.
Toledo 11, Ohio
Canada:
Montreal, Quebec
Toronto, Ontario
Windsor, Ontario

THIS MOTOR BRACKET typifies the advantages of modern EASY-FLO Brazed Construction

This hanger bracket for a small electric motor used in airplanes is one of a long and growing list of parts formerly made from castings or forgings that have been redesigned for EASY-FLO brazed construction.

The reasons so many are changing to EASY-FLO brazed construction are—faster production—elimination of machine operations—reduction in weight—metal saving—and last but not least, low costs.

EASY-FLO IS THE KEY to the success of this low-temperature silver alloy brazed construction, because it makes joints that are as strong as solid metal—and makes them fast, reliably and at surprisingly low cost per joint.

You will find interesting details about it in **Bulletin No. 12.** Also valuable information on joint designs, heating methods and fast production procedures. A copy will be mailed to you on request—write for it now.

EASY-FLO BRAZING IS HERE TO STAY. *The exceptional speed, reliability and economy EASY-FLO brings to the joining of both ferrous and nonferrous metals account for the phenomenal spread in its use on war production and assure an increasing use in peacetime manufacturing. Get the facts in Bulletin No. 12-A. Plan to use it in your post-war production.*

STEEL SALES CORPORATION

WAREHOUSES
Chicago, Ill., 3348 S. Pulaski Rd., Phone Crawford 4400
Detroit, Mich., 5151 Wesson Ave., Phone Tyler 6-3000
St. Louis, Mo., 4565 McRee Ave., Phone Grand 5255

DISTRICT OFFICES
3348 S. Pulaski Road Chicago, Illinois Milwaukee Minneapolis

H. H. Smith, formerly works metallurgist of the Donora Steel & Wire Works, Donora, Pa., has been appointed assistant manager, metallurgical department of the American Steel & Wire Co., Cleveland, a subsidiary of U. S. Steel Corp. Mr. Smith replaces the late **Lawrence H. Dunham,** who died in January of this year. His position at Donora will be filled by **R. A. Woodside,** a former division metallurgist.

» «

Dr. Samuel L. Hoyt, technical advisor, Battelle Institute, Columbus, O., was selected by the Golden Gate Chapter of the American Society for Metals to present its 1944 educational lectures. These lectures, on the subject "Properties, Selection and Specification of Alloys," were delivered at the University of California, Berkeley, April 19 to 25.

» «

Russell E. Ebersole has been elected lamp sales manager of the Westinghouse Lamp Division, Bloomfield, N. J. He was formerly manager of the middle western district, with headquarters in Chicago.

» «

Vincent Manka, formerly on the advertising staff of Colgate-Palmolive Peet Co., has been appointed assistant to the president of the Claud S. Gordon Co., Chicago. He will handle the distribution of information concerning new developments, procedures and other data of interest to the metal industry.

» «

William C. Johnson, James M. White and **William A. Roberts** were recently elected vice-presidents of the Allis-Chalmers Mfg. Co., Milwaukee. Mr. Johnson is also general sales manager, Mr. White works manager and Mr. Roberts manager of the company's tractor division.

» «

Bruno R. Neumann, until recently senior economist with the planning division of the War Production Board, has joined the National Foremen's Institute, Inc., Deep River, Conn., as labor economist and editorial director.

» «

John Avery has been appointed manager of the Allis-Chalmers blower and compressor department to succeed **G. L. Kollberg,** who is retiring after 47 years of service. Mr. Avery has been assistant manager of the blower and compressor department since 1935.

» «

Daniel D. Eyster, formerly with Nash-Kelvinator Corp. as staff engineer on special assignments and welding methods, is now treasurer and manager of Acro Welder Mfg. Co., Milwaukee manufacturer of resistance welding equipment.

» «

Frank M. Blum has been appointed manager of the P&H Crane Sales Division of Harnischfeger Corp., Milwaukee, to succeed **Ben Van Horn,** retired. Mr. Blum has been assistant manager of the division since 1938.

» «

J. K. Gannett, vice-president of The Austin Co., Cleveland, and its eastern district manager, has been appointed director of engineering, in charge of engineering and research. Vice-Presidents **Albert S. Low** and **A. F. Plant** have been elected directors of this concern.

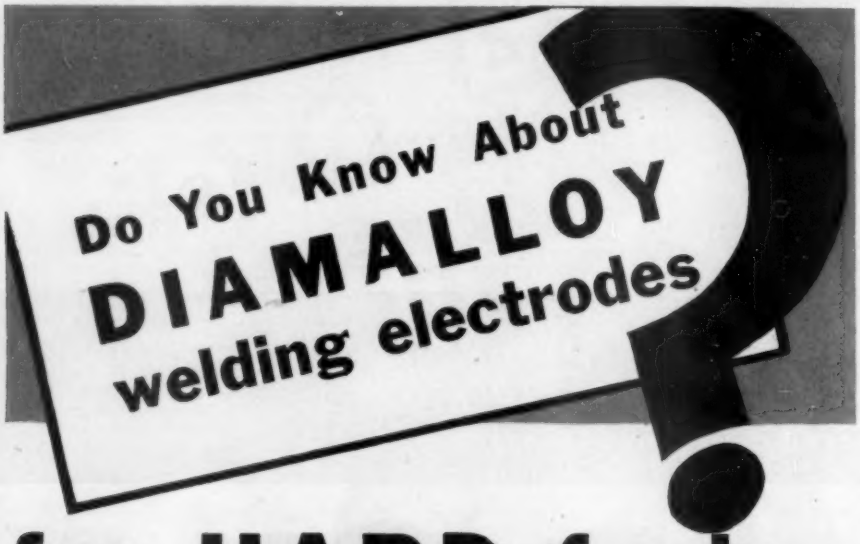
» «

G. E. Powell of Gloversville, N. Y., is now representing the Colonial Co., Boston manufacturer of leather and patent fabric.

» «

Died . . .

Hugh Walter Spaulding secretary of Handy & Harman, New York City, died on March 31. He was well known throughout the silver exchange centers of the world, having served Handy & Harman as silver trader in both domestic and foreign operations. He had been with the company since 1902.



for HARD facing

We want you to try DIAMALLOY on the TOUGHEST job in your plant--you will like this superior, all position, hard facing rod--you will like its easy handling--its longer resistance to abrasion and corrosion--its ability to withstand heat and impact--AND, after you have proved to yourself that there is no better rod made, at any price--THEN look at the DIAMALLOY price list! Write for free samples.

DO IT NOW

SEND FREE SAMPLES OF DIAMALLOY TO

Company _____

Address _____

Buyer _____

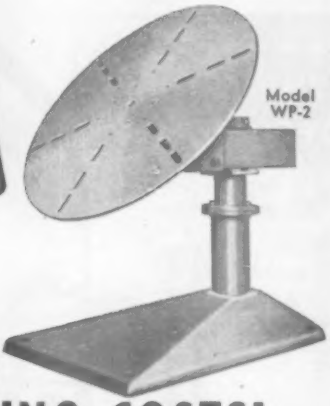
Send Samples Checked ☐ 1-8 ☐ 5-32 ☐ 3-16 ☐ 1-4

Please Supply Jobbers Name - Address in your Territory

The DIAMALLOY Co.

GOWANDA, N. Y.

P&H WELDING POSITIONERS



NEW!
LOW PRICED!
CUTS WELDING COSTS!

- 2500 pound capacity at surprisingly low cost.
- All-welded rolled steel construction.
- Most versatile positioner in its class. Simple and easy to operate.
- Large table area with handy slots.
- Hydraulic power tilting.
- No exposed gearing.
- Manual turning to suit welding speed. Positive table locking device.
- Telescopic elevation.
- Portable or column-in-floor mounting.
- Also available with handwheel or power turning.

Write today for Bulletin P-2

General Offices: 4513 West National Avenue, Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION

ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

Canadian Distribution: The Canadian Fairbanks-Morse Co., Ltd.

FOR QUICKER
Grinding, Sanding, Drilling, Buffing . . .
Take the TOOL TO THE JOB!

STOW FLEXIBLE SHAFT MACHINES
. . . Save Effort . . . Speed Output

Stow Mobile Power units save moving or positioning heavy pieces. They reach the work from any angle, cut "make ready" time to a minimum. Stow Flexible Shaft Machines have rugged dependability plus the easy portability required by today's hurry-up schedules. Our new catalog is just out, containing information which every production and purchasing man should have. Write for it today!

NOW! Stow Separate Shafts for Your Own Motor!

A Stow Flexible Shaft, plus the great variety of attachments available, quickly converts any idle motor into rotary file, wire brush, heavy-duty drill, grinding wheel, etc. Write for information on lengths, sizes, attachments, etc.

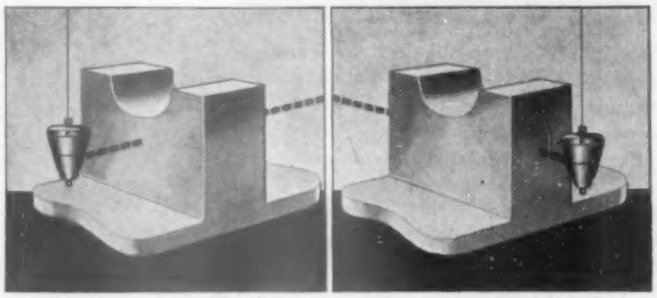
STOW Manufacturing Co.
7 Shear St., Binghamton, N. Y.

CANADIAN RADIUM IN MODERN INDUSTRY

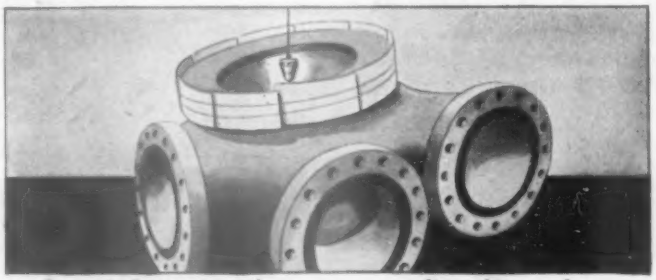
EASY WAY TO DETECT INTERNAL FLAWS

CANADIAN RADIUM SAVES

TIME, LABOR, MATERIALS
— INSURES SOUND PRODUCTION



Checking and cross-checking a metal section to insure positive detection of flaws, such as tight cracks, is easy with radium. Its Gamma-rays penetrate up to 10 inches of solid steel.



In a single exposure, clear, permanent radiographic records are made through critical areas on both sides of a ponderous casting, simply by suspending a radium capsule inside the aperture.

R-34

Write for Free Manual

Reliable, profusely illustrated 80-page textbook on the fundamentals and technique of modern Industrial Radiography of Metals with Radium. Specially prepared for the metals industry by our research and technical staff. Write for your copy today, giving your name and company position.

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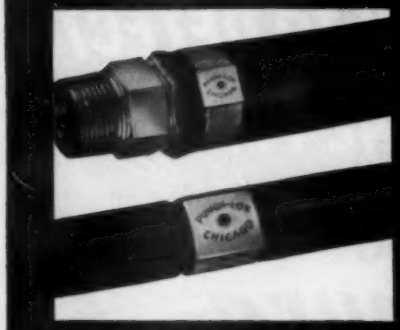

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Chicago 7, Illinois

FROM THE PATENT OFFICE

Multiple-Core Electrode

2,345,758. **James F. Lincoln,** Cleveland, and **Theophil E. Jerabek,** East Cleveland, assigned to **The Lincoln Electric Co.,** Cleveland. Filed April 21, 1942. Issued April 4, 1944.

Instead of the conventional solid core, this electrode has a plurality of concentric metal shells, each sheathed with electrode-coating material. The arc is maintained between the work and the innermost one of the coaxially arranged metallic components.

» «

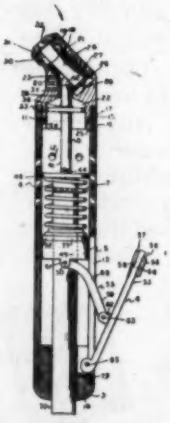
Arc-Welding Method

2,345,037. **William G. De Gray,** Buffalo, N. Y., assigned to **Bell Aircraft Corp.,** Buffalo. Filed Oct. 20, 1942. Issued March 28, 1944.

A method of arc welding relatively thin metal plates lapped against each other. The steps are: (1) to apply the arc to the outer surface of one plate in order to oxidize the material and burn registering openings extending through both plates, (2) to reduce the heating value of the arc to fusing temperature and (3) to fill the registered openings with filler metal in the presence of a flux. These steps are carried on continuously and completely with the arcing electrode located at one side of the joint.

» «

Electrode Holder



2,345,532. **Paul Eriksen,** Lansdowne, Pa., assigned 75% to **Samuel Albert,** Philadelphia. Filed April 13, 1942. Issued March 28, 1944.

An electrode holder with an electrode-receiving chamber formed within a casing. An electrode-clamping bar is mounted in the casing for longitudinal movement to and from clamping position and for rotative movement within the casing. A cable-connecting means attached to the electrode-clamping bar is mounted for similar longitudinal and rotative movements. A means for actuating the cable coupling and a means for moving the coupling-actuating means to a predetermined position are also mounted within the casing.

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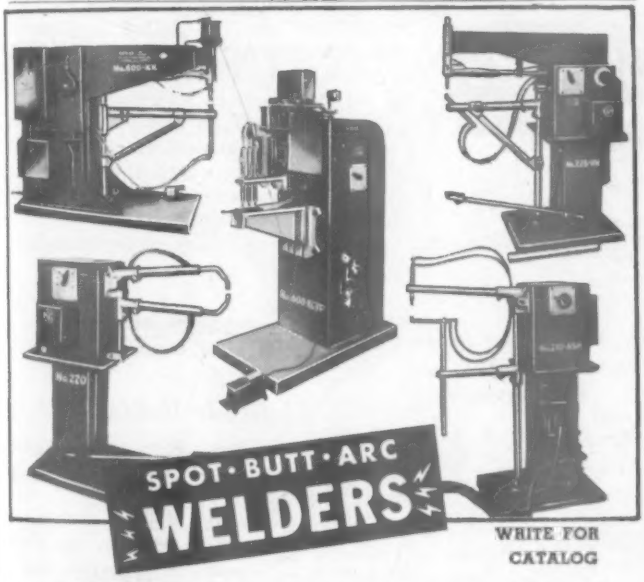

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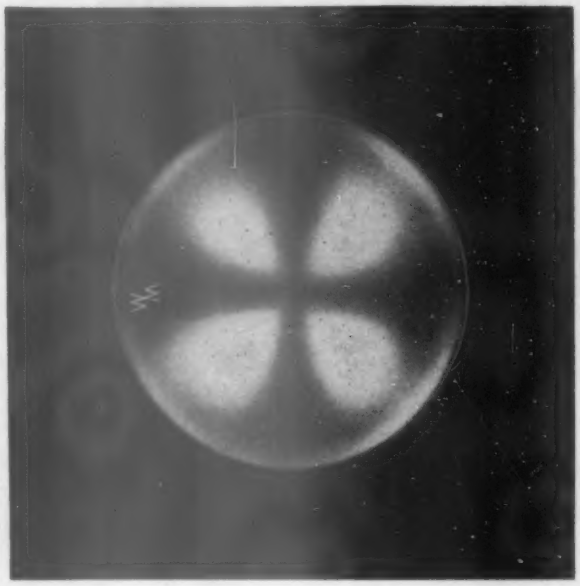

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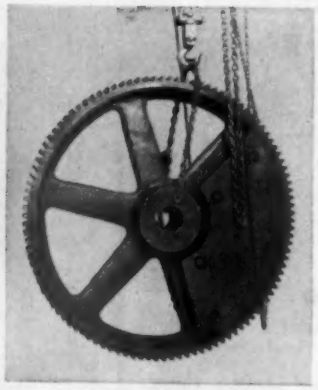

The bore of this gear wheel was oversize, and removal of the shaft to build it up would be extremely difficult because of the amount of machinery tied in at the other end. The solution was to build up the bore of the wheel by electric arc welding, using PHILLIPS "600" Electrode. The deposit from this electrode is of the color of cast iron and is fully machinable, even through the line of fusion. All details of the process are explained in our free manual, "4 Ways to Salvage, Reclaim and Conserve Iron Castings by Electric Arc Welding." Send for your copy TODAY.

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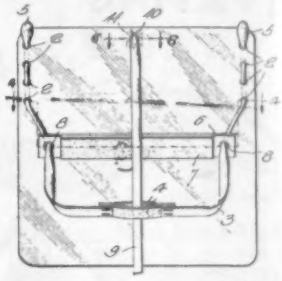
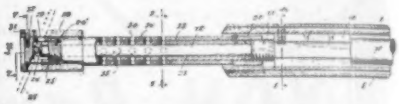
Face and Eye Shield

2,342,982. **Nathan R. Stern** and **Michael P. Newberger**, Cleveland. Filed Dec. 28, 1942. Issued Feb. 29, 1944.



A face and eyeshield formed of a sheet of transparent plastic and held in place by a head strap connected to the upper edges of sheet. A forehead strap frictionally supported on the head strap provides adjustment toward and from the sheet.

Electrode Holder

2,343,799. **John M. Radabaugh**, Mount Vernon, O. Filed Aug. 6, 1942. Issued March 7, 1944.

An electrode holder with a longitudinally adjustable fitting having a threaded portion to engage the threads of a surrounding tube. An electrode-supporting tip is secured to the tube. An insulating jacket is detachably secured to and surrounds the tip; this jacket is provided with interior angular walls engaging the tip and defining air passages. The end of the jacket is spaced longitudinally from the adjacent end of the tip to form a guard to prevent grounding of the holder. A handle connects with the fitting for rotation of the latter into clamping engagement with the electrode.

» «

Electrode Holder

2,342,966. **James Edward Paulson**, Long Beach, Calif. Filed Jan. 22, 1943. Issued Feb. 29, 1944.

In this electrode holder, a tubular socket member of conductive material has a covering sheath of insulation material and a transverse bore for insertion of the shank of an electrode. The bore is adjacent to the closed or leading end of the holder and oblique to the axis of the socket member. An adapter having a conductor connected at one end is connected at its other end to the tail end of the socket member. The connecting means has a coupling rotatable on the socket's tail end and feeding forwardly of the socket. Electrode shank is clamped in the bore by a means operative by the forward feed of this coupling. There is also a telescopic snap action connection between the adapter and coupling.

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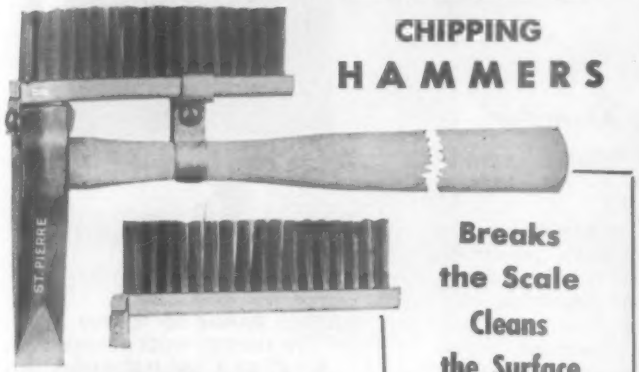

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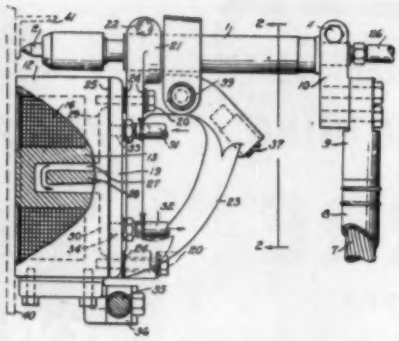


Poke-Welding Apparatus

2,345,630. **Clarence Ringwald,** Springfield, O. Filed Sept. 2, 1942. Issued April 4, 1944.

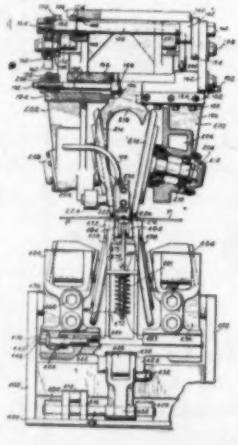
Resistance welding apparatus of the type which has a single electrode. The electric circuit also includes a transformer and an electrode-supporting electromagnet excited by direct current. The electromagnet is adapted to be clamped to the work closely adjacent the point of the welding operation; it is in series with the welding electrode, and its body acts as a second electrode through which the welding current flows after passing through the work. Both the welding electrode and electromagnet are located on the same side of the work.

» «

Automatic Gas Welding

2,344,534. **James H. Bucknam** and **Alfred J. Miller,** Cranford, and **Stanley H. Royer,** Elizabeth, N. J., assigned to **The Linde Air Products Co., Inc.** Filed Feb. 3, 1938. Issued March 21, 1944.

This automatic gas-welding machine is designed to butt weld thin sheets in a strip mill. The welding torch is mounted on a carriage which moves along the juxtaposed edges of the sheets. A presser foot on the carriage engages the sheets in advance of the torch, while rollers mounted on the bearing housings engage the sheets adjacent to the torch. A water-spray block is mounted on the carriage behind the torch in order to quench the weld and so localize the heat.



» «

Electrode Coating

2,344,621. **Paul C. Lemmerman,** Cleveland Heights, O., assigned to **E. I. du Pont de Nemours & Co.,** Wilmington, Del. Filed March 26, 1942. Issued March 21, 1944.

An electrode coated with potassium silicate having a silicon dioxide to potassium oxide mole (gram-molecular weight) ratio of about 3.25.

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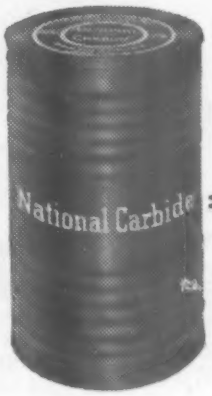

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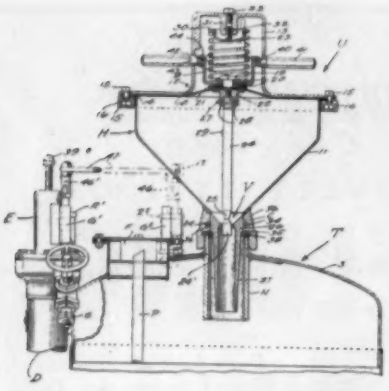

Acetylene Generator Regulator

2,344,564. **Willis G. Schepman,** Indianapolis, assigned to **Union Carbide and Carbon Corp.** Filed Nov. 28, 1941. Issued March 21, 1944.

A device for an acetylene generator carbide hopper and feed control unit in which the flow of carbide is controlled by a feed valve connected to a diaphragm subjected on one side to the pressure of the acetylene within the generator. The patent covers the combination of a spring cup connected to the other side of the diaphragm, a spring seated in the cup and acting in opposition to the acetylene pressure and a means for raising cup and diaphragm against the force of the spring in order to close the carbide feed valve. The latter means engages the cup and is rotatable about the vertical axis thereof.

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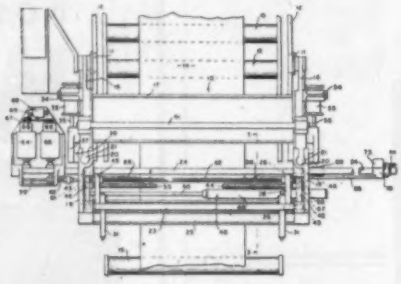
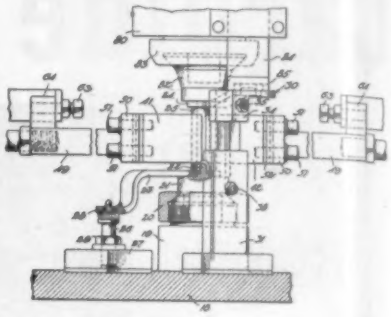


Flame-Cutting Machine

2,345,314. **James L. Anderson,** Closter, N. J., assigned to **Air Reduction Co. Inc.,** New York City. Filed Aug. 26, 1941. Issued March 28, 1944.

This flame-cutting apparatus has a carriage which moves along a supporting track. Carriage has an abutment in position to contact with the side of the body to be cut, and the torch holder is moved into position to start the cut when this abutment is against the side of the body. Torch holder is movable on a support and is caused to move with respect to the carriage along a projected line of cut.

» «



Flash Welder

2,344,875. **Edmond J. P. James,** Akron, O., assigned to **Packard Motor Car Co.,** Detroit. Filed March 6, 1942. Issued March 21, 1944.

This flash welder has a head carrying a movable pressure-operated electrode and a bed with a fixed electrode. The work is clamped in position for welding between conductor members movable normal to the electrodes; a carrier for these conductor members is supported on the bed.

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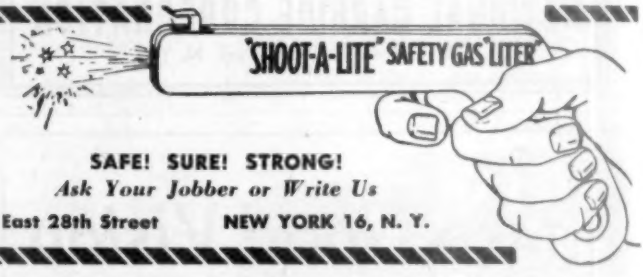

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This hi-frequency unit can be attached to all welders. Super-imposes over a million cycles. Constant flow of current, automatic arc and other features increase speed and ease of operation. Arc starts *before* rod touches work. Excels on 22 gauge as well as heavy. No arc blow. Burns any rod, steel or alloy, bare or coated. No "scratching or sticking" of electrode to work. These and other features make it easy for even a bookkeeper to become a good welder quickly. A big help to experienced welders too. We urge you—order the "MISSING LINK" today...it will work wonders in your welding department.
If its a welding problem we can help you!

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The NEW, IMPROVED Variable-Core type

GREYHOUND

A. C. Arc Welders Provide LOWER OPERATING COSTS for HEAVY DUTY PRODUCTION

Detailed information and prices sent on request

Distributors Wanted

GREYHOUND A. C. ARC WELDER CORP.
Manufacturers
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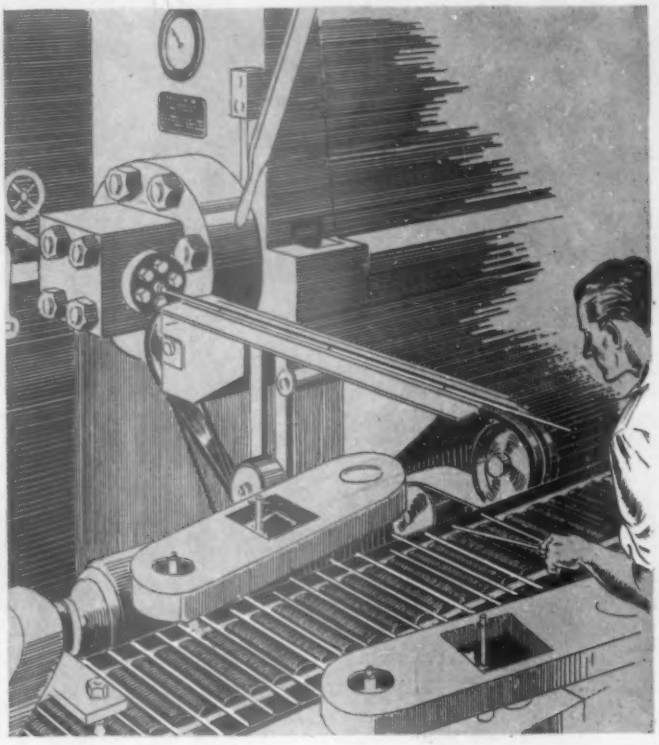

TITANOX-A

(titanium dioxide)

offers Many Advantages to the Welding Rod Coater

Here are some of the benefits you will enjoy when you use this pure precipitated titanium dioxide in your welding rod coatings:

Uniformity of chemical composition . . . Ease of mixing . . . Minimizing of extrusion problems . . . Non-reaction with other ingredients of the mix . . . Low content of phosphates and sulphates . . . Freedom from objectionable metals.

In addition welding rods coated with TITANOX-A contribute to stability of the arc, increase speed of welding, give more protective slag, and make for higher tensile strength and ductility.

We will gladly advise you regarding the application of TITANOX-A to your specific requirement.

TITANOX

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TITANIUM PIGMENT CORPORATION, *Sole Sales Agent*

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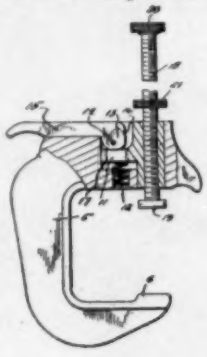
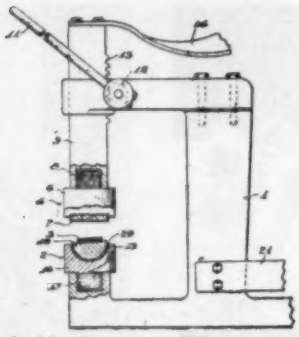
C-Clamp

2,343,699. **Allen P. Petersen,** Hutchinson, Minn. Filed July 25, 1942. Issued March 7, 1944.

A clamp with a C-shaped body having a stationary jaw at one end and a cylindrical bore in the opposite. The movable jaw is adjustably mounted in a barrel sliding within the bore. An arm projecting laterally from the barrel is slidably positioned in a recess in order to prevent rotation of the barrel. A spring bearing against the underside of the arm urges the barrel away from the stationary jaw. A manually operable cam engages the upper side of arm opposite spring to force movable jaw into clamping position.

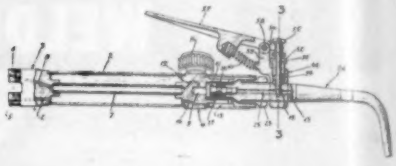




Self-Aligning Electrode

2,346,088. **Erle I. Shobert, II,** St. Marys Pa. assigned to **Stackpole Carbon Co.,** St. Marys. Filed Feb. 5, 1943. Issued April 4, 1944.

A self-aligning spot-welding electrode consisting of a hemispherical tip and a tip-supporting member. Tip's flat side is adapted to engage the work. The hemispherical surface is received in a recess provided in the tip-supporting member, and is universally movable therein without disturbance to the center of the flat side.



Cutting Torch

2,344,219. **Elmer H. Smith,** Minneapolis, assigned to **Smith Welding Equipment Corp.,** Minneapolis. Filed Oct. 10, 1940. Issued March 14, 1944.

The cutting tip of this torch is detachably and adjustably supported in a socket in the head. The tip consists of a cylindrical body and an elongated slender end; both body and end portions have a longitudinally extending central passage communicating with the oxygen supply to the socket. The valve for controlling the flow of cutting oxygen is secured to the cylindrical portion of the torch tip and is removable with tip.

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BY APPLYING WIESE UNITS TO AGRICULTURAL TOOLS
Prepare your shop for this type of work
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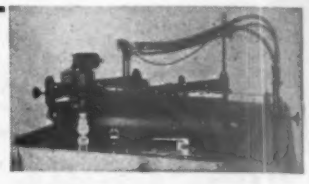
AUTOMATIC SHAPE CUTTING MACHINES
Popular models and sizes. Gas and electric welding supplies; TIPS for various makes of torches. Safety Equipment and Clothing.
Large stocks—prompt deliveries.
RALL SUPPLY COMPANY, 110 E. 42nd St., New York, N. Y.



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We have in stock the following types of Welding Wire for electric arc welding:

STAINLESS STEEL ELECTRODES
HARD-SURFACING ELECTRODES
MILD CARBON ELECTRODES

Quick delivery, also, on Welding Machines, Protect-O-Metal for the elimination of weld spatter and Havens "C" Protected Clamps. Your inquiries will receive prompt, courteous attention—phone, write or wire our warehouse nearest you.

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UNITED STATES STEEL

WELDING TABLE

THREE SIZES — 3, 4, 5 ft. Diameter.
Top of ⅜ in. steel plate; *heavier plate optional.*
Height, 30 inches; *height optional.*

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FOURTEEN YEARS OF PROVEN SERVICE

"VISION FOR VICTORY"
Safeguard your sight. Good sight is a precious possession. Take the best possible care of your eyes. Ever-Klear Cover Lens will aid you in doing this. They will not pit or allow molten sparks to fuse on the surface, insuring clear vision at all times.

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Sizes 46½ to 50 M.M., for goggles.....35c per pair

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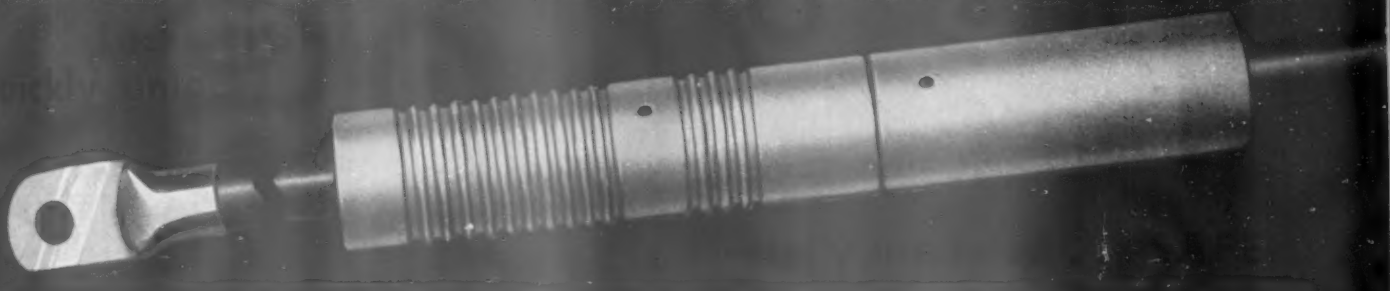
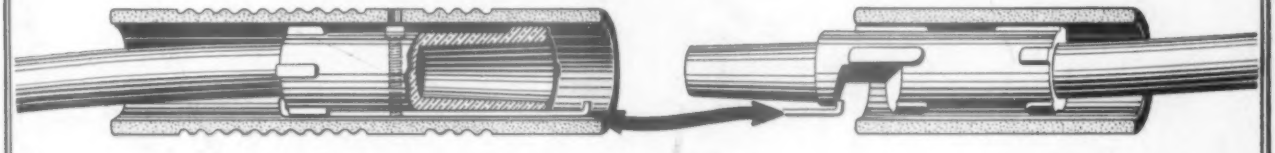
Jackson's QUIK-TRIK CABLE CONNECTOR

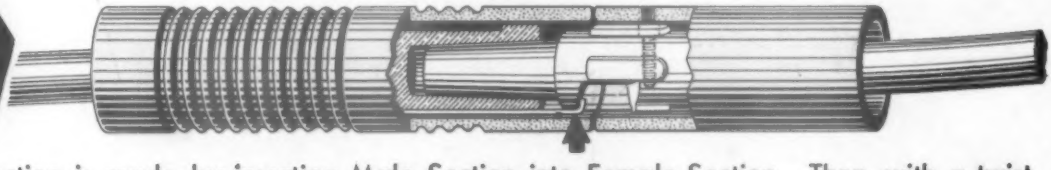




Female Section is soldered to cable lead Male Section is soldered to cable extension

Removable insulators are securely held in protective position with Allen screws.

HOW IT WORKS..



Connection is made by inserting Male Section into Female Section. Then, with a twist, the locking spring rides the cam into position holding both sections tight.

To unlock, simply twist apart.

PATENT APPLIED FOR

Important: Female Section, installed on cable lead, as shown above, may also be used as a handle and connected directly to the "Stinger" end of a Jackson Model TA holder as shown below. The adaptation saves time and material, eliminates the danger of live cable ends and makes possible the economies of standardization.

JACKSON PRODUCTS, 3265 Wight St., Detroit, Michigan

Announcing

THE NEW WESTINGHOUSE

Multi-weld

TYPE G MULTIPLE-OUTLET WELDING PANEL

Now, with the new Westinghouse liquid-cooled MULTI-WELD PANEL, as many as ten welders can operate from a single, compact power source. Twenty different current steps are available at each of the ten outlets. Transmission losses due to long leads are reduced and considerable lead cable is saved.

This new multiple-outlet welding panel is the only unit of its kind using liquid cooling for resistors. This design produces a smoother arc, without the current surges common to air-cooled units. It also permits smaller size, so that the panel can be easily moved—passed through doorways and hatches and brought right to the job—with consequent saving in cable, current and operating time.

Get the facts about how this new unit can increase efficiency in your multi-welding operations—write for Booklet B-3352. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-70432

Ten outlets in one compact portable unit

Ten-ampere steps in current rating available over range of unit.

Liquid-cooled resistors—the only design of its kind for use in constant potential welding.

10 to 200, 300 or 400 amperes—60 or 70 constant potential voltage—for use with multiple-operator weld sets.

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